

REVISION OF *PYLOPAGURUS* AND *TOMOPAGURUS* (CRUSTACEA: DECAPODA: PAGURIDAE), WITH THE DESCRIPTIONS OF NEW GENERA AND SPECIES.

PART IV.

LOPHOPAGURUS McLAUGHLIN AND *AUSTRALEREMUS* McLAUGHLIN

BY PATSY A. McLAUGHLIN¹ AND S. W. GUNN²

¹ Shannon Point Marine Center, 1900 Shannon Point Road, Anacortes, Washington 98221-4042, USA
² Department of Crustacea, Museum of Victoria, Swanston Street, Melbourne, Victoria 3000, Australia

Abstract

McLaughlin, P.A. and Gunn, S.W., 1992. Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with descriptions of new genera and species. Part IV. *Lophopagurus* McLaughlin and *Australeremus* McLaughlin. *Memoirs of the Museum of Victoria* 53: 43-99.

In this fourth of a six-part series, the genera *Lophopagurus*, and *Australeremus* as herein emended, and their respective species are redescribed and illustrated. The identity of *Lophopagurus thompsoni* (Filhol) is defined by lectotype selection and a species heretofore confounded with it is described as *Lophopagurus foresti* sp. nov. One additional new species of *Lophopagurus*, *L. nodulosus* sp. nov. is also described. The assignment of *Pylopagurus cristatus* (H. Milne Edwards) to *Lophopagurus* is refuted; it is reassigned to *Australeremus*. The questionable assignment of *Pylopagurus kirkii* (Filhol) to *Australeremus* is confirmed. *Pagurus triserratus* (Ortmann) has been determined to be the senior subjective synonym of *Pylopagurus serpulophilus* Miyake. It and *Pylopagurus stewarti* (Filhol) are also assigned to *Australeremus* and two new species, *A. laurentae* sp. nov. and *A. eltaninae* sp. nov., are described in this genus. Keys to the species are presented for both genera.

Contents

Introduction	43
Materials	44
<i>Lophopagurus</i>	45
Key to species of <i>Lophopagurus</i>	46
<i>Lophopagurus thompsoni</i> (Filhol)	47
<i>Lophopagurus foresti</i> sp. nov.	52
<i>Lophopagurus nodulosus</i> sp. nov.	55
<i>Lophopagurus crenatus</i> (Borradaile)	58
<i>Lophopagurus lacertosus</i> (Henderson)	61
<i>Lophopagurus nanus</i> (Henderson)	65
<i>Australeremus</i>	68
Key to the species of <i>Australeremus</i>	70
<i>Australeremus cookii</i> (Filhol)	70
<i>Australeremus laurentae</i> sp. nov.	74
<i>Australeremus cristatus</i> (H. Milne Edwards)	77
<i>Australeremus kirkii</i> (Filhol)	80
<i>Australeremus stewarti</i> (Filhol)	83
<i>Australeremus triserratus</i> (Ortmann)	87
<i>Australeremus eltaninae</i> sp. nov.	92
Acknowledgements	94
References	95

Introduction

More than 15 years ago, Jacques Forest and Michèle de Saint Laurent (Muséum National d'Histoire Naturelle, Paris) began a review and

revision of the taxonomy of the hermit crabs of New Zealand (R.L.C. Pilgrim, pers. comm.; Schembri and McLay, 1983; J. Forest, J. Yaldwyn, pers. comms.). The efforts of these

well known careinologists initially were focused on the Coenobitoidea; however, they recognized the need for, and began, revisionary work in the Paguroidea as well. It was, in part, through their help that one of us (PMcL) was able to make inaugural subdivisions of the heterogeneous genus *Pylopagurus*.

In Part I of what is to be a six part revision, *Pylopagurus* Milne Edwards and Bouvier, 1891, was restricted to species typified by *P. discoidalis* (A. Milne Edwards, 1880); the remaining species assigned to *Pylopagurus* by A. Milne Edwards and Bouvier (1893) were transferred to new genera (McLaughlin, 1981a). Part II dealt with the western Atlantic-Eastern Pacific genera *Rhodochirus* McLaughlin and *Phimochirus* McLaughlin (McLaughlin, 1981b), and Part III presented diagnoses and descriptions of new species of the Atlantic genus *Agaricochirus* McLaughlin and the Pacific genera *Enallopagurus* McLaughlin and *Enallopaguopsis* McLaughlin (McLaughlin, 1982). Part IV reports on species assigned to *Lophopagurus* McLaughlin and *Australeremus* McLaughlin, together with descriptions of four new species.

Among the taxa characterized by 11 pairs of phyllobranch gills and females with paired 1st pleopods modified as gonopods, *Lophopagurus* is distinctive in the form of the left chelae of its members. There is little variation in the configuration of the chela among the assigned species, all of which apparently are endemic to the waters of New Zealand and southern Australia. However, the genus can be divided into two distinct, and presumably evolutionary sister-groups on the basis of the similarity or dissimilarity of the dactyls and occasionally also the propodi of the ambulatory legs. Although such variations have not been observed in other pylopagurid-like genera, somewhat analogous dissimilarities between left third and the remaining right and left pereopods have been reported in certain species of *Pylopaguopsis*, a genus in which female gonopods are also present but one immediately distinguishable from pylopagurid-like genera by the presence of 13 pairs of trichobranchiate gills (McLaughlin and Haig, 1989).

When originally diagnosed (McLaughlin, 1981a), *Australeremus* was represented only by its type species, *Eupagurus cookii* Filhol, 1883, and with the questionably assignment of *Eupagurus kirkii* Filhol, 1883. However, new data have shown that the diagnosis of *Australeremus* requires emendation, and that at least one of its representatives occurs in the more northern

waters of Japan and China. The uncertain assignment of *E. kirkii* to the genus is confirmed.

Pagurus cristatus H. Milne Edwards, 1836, which had been questionably assigned to *Lophopagurus* by McLaughlin (1981a), is now recognized as properly belonging to *Australeremus*. Two of the species first included by McLaughlin (1981a) in *Pylopagurus* sensu strieto, i.e., *P. stewarti* (Filhol) and *P. serpulophilus* Miyake, must now be transferred to *Australeremus*. Miyake's species is believed to be a junior subjective synonym of *Eupagurus triserratus* Ortman. Additionally, two new species of *Australeremus* are described from New Zealand waters.

Identification of species of *Lophopagurus* and *Australeremus* is complicated by the high degree of intrageneric similarities exhibited by their respective taxa. Moreover, species of both genera exhibit considerable intraspecific variation, particularly in the strength of the armature of the right cheliped. Additionally, characters such as length-width ratios and the development of spines on the segments of the pereopods vary with specimen size, geographic distribution and/or habitat. In contrast, colour patterns frequently appear to be duplicated. Keys to the genera have been developed using relatively stable characters and do provide assistance in species recognition. However, it is strongly recommended that the species descriptions be referred to for all but the most "classic" representatives.

Materials

The material for this study came initially from the United States Antarctic Program (USARP), through the auspices of the Smithsonian Oceanographic Sorting Center (SOSC). This material has been augmented by specimens from the collections of the Australian Museum, Sydney (AM), California Academy of Sciences, San Francisco (CAS), Canterbury Museum, Christchurch (CMC), Musée de Zoologie, Université de Strasbourg (MZUS), Muséum National d'Histoire Naturelle, Paris (MNHN), Museum of Victoria, Melbourne (NMV), New Zealand Department of Conservation (NZDC), New Zealand Oceanographic Institute, Wellington (NZOI), National Museum of Natural History, Smithsonian Institution (USNM), National Museum of New Zealand, Wellington (NMNZ), Nationaal Natuurhistorisch Museum, formerly Rijksmuseum van Natuurlijke Historie, Leiden

(RMNH), Naturhistoriska Riksmuseet, Stockholm (NHRM), Portobello Marine Laboratory, University of Otago, Dunedin (PML), The Natural History Museum, formerly British Museum (Natural History), London (BMNH), and Zoologiska Museet, Uppsala Universitet, Uppsala (ZMUU). Primary type specimens (holotypes and paratypes) from USARP collections are deposited in the National Museum of Natural History; when available, supplemental materials have been distributed among the aforementioned museums. All other specimens have been returned to their repositories of origin or deposited in one or more of the aforementioned institutions. As much as possible institutional abbreviations have been taken from the Standard Symbolic Codes for Institutional

Resource Collections . . . (Leviton et al., 1985). A single measurement, shield length (SL) provides an indication of specimen size.

Lophopagurus McLaughlin, 1981

Pylopagurus. — Forest and de Saint Laurent, 1967: 145 (in part), not *Pylopagurus* Milne Edwards and Bouvier, 1891.

Lophopagurus McLaughlin, 1981a: 3 (type species, by original designation: *Eupagurus thompsoni* Filhol, 1885a. Gender masculine.)

Diagnosis. Eleven pairs of phyllobranch gills. Ocular acicles narrowly triangular, with strong submarginal spine, and rarely accessory spinule; separated basally by slightly less to considerably more than basal width of 1 acicle. Sternite of 3rd

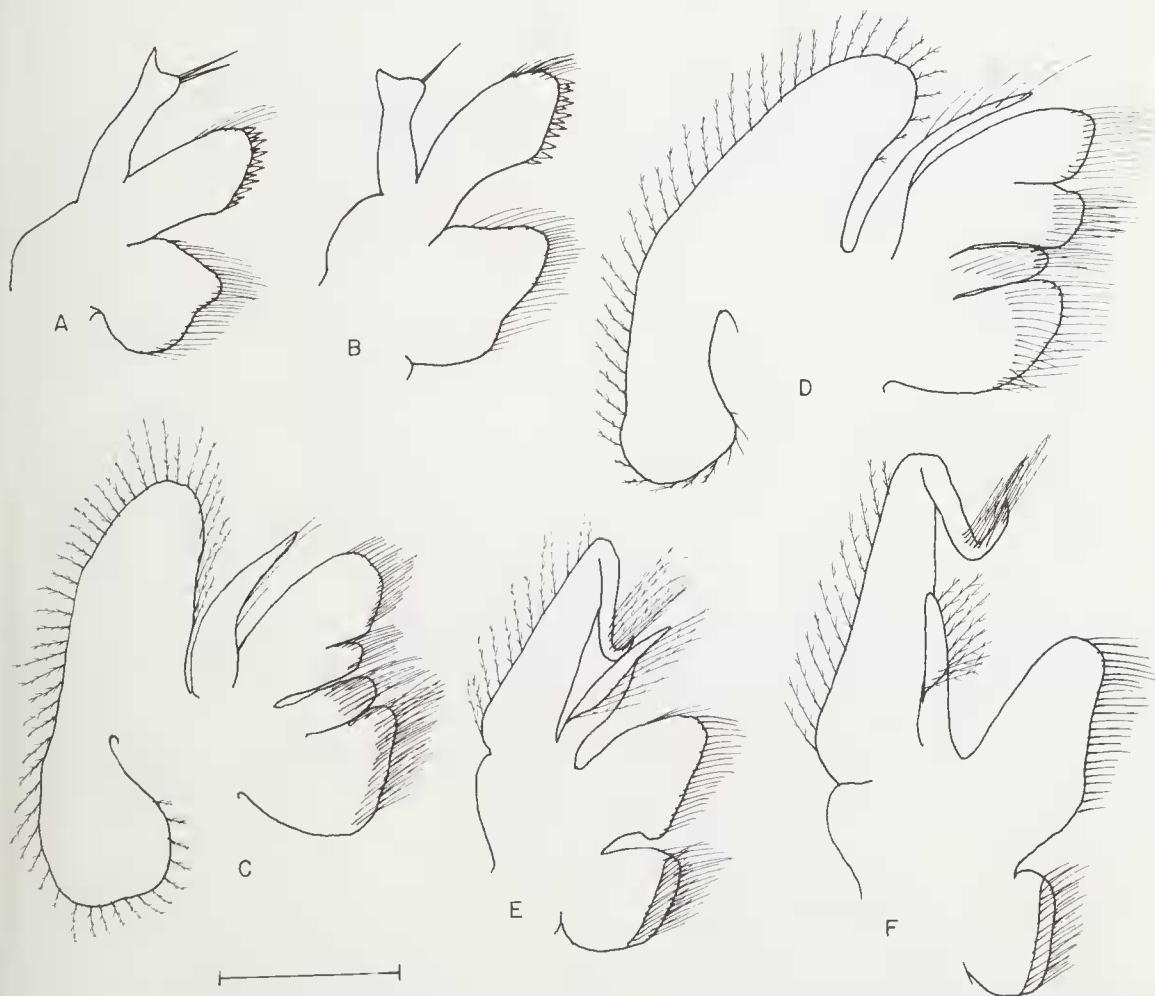


Figure 1. *Lophopagurus*. A, C, E, *L. foresti* sp. nov.. A, maxillule; C, maxilla; E, first maxilliped. B, D, F, *L. nanus* (Henderson), B, maxillule; D, maxilla, F, first maxilliped. Scale = 1.0 mm (A, C, E) and 0.5 mm (B, D, F).

maxillipeds usually unarmed. Basal antennular segment with prominent lateral spine and with ventrodistal margin produced into elongate, slender lobe. Maxillule (Fig. 1A, B) with external lobe well developed, not recurved, internal lobe with 1 or 2 terminal bristles. Maxilla (C, D) with proximal lobe of scaphognathite not appreciably broadened. First maxilliped (Fig. 1E, F) with slender exopod. Third maxilliped with well developed crista dentata and prominent accessory tooth; merus sometimes with spine at dorsodistal margin.

Right cheliped with chela longer than broad; angle of propodal-carpal articulation 0° – 15° from horizontal plane; dorsolateral margin of palm curved, dorsomesial margin depressed, dorsal surface with straight or concave dorsomesial component (Fig. 2B, 6B), delineated by row(s) of spines or tubercles, remaining dorsal surface with 1 or 2 narrow to moderately broad, tuberculate or spinose ridges. Left cheliped with chela broadly triangular in cross-section and dorsal view; dorsolateral margin depressed, dorsal midline elevated into prominent spinose or tuberculate keel or crest; propodal-carpal articulation 0° – 25° from horizontal plane. Dactyls of ambulatory legs with lateral faces variable (rounded, flattened, marked by prominent longitudinal sulci, slightly or conspicuously concave). Sternite of 3rd pereopods with anterior projection subsemicircular to subrectangular, occasionally with 1 or 2 marginal spines. Fourth pereopods with propodal rasp consisting of single row of corneous scales; dactyl usually with small to moderately well developed preungual process at base of claw. Pereopodal bases and coxae often with dense tufts of long setae.

Abdomen typically flexed. Uropods asymmetrical. Telson with transverse suture; posterior lobes symmetrical or slightly asymmetrical, terminal margins straight, oblique or rounded, armed with numerous small to moderately strong spines, lateral margins denticulate, spinulose or spinose. Males without paired pleopods, with 3 unpaired, unequally biramous left pleopods. Females with paired 1st pleopods modified as gonopods, with 4 unpaired biramous left

pleopods, 2nd–4th with both rami well developed, 5th with endopod reduced.

Distribution. New Zealand and south-eastern Australia, subtidal to 840 m.

Etymology. *Lophopagurus* is from the Greek *lophos*, the crest, and *pagouros* a crab, and refers to the crested left chela characteristic of this genus.

Remarks. McLaughlin (1981a) tentatively assigned *Pylopagurus cristatus* (H. Milne Edwards) to *Lophopagurus* on the basis of a photograph graciously provided by J. Forest and M. de Saint Laurent. During the course of the present study, we have had the opportunity to examine representatives of this taxon and have found that it is not correctly assignable to *Lophopagurus*. It is herein transferred to *Australeremus*.

As previously mentioned, species of *Lophopagurus* can be divided into two distinct, and seemingly evolutionary sister-groups. The first, and presumably ancestral group, which includes *L. lacertosus* (Henderson), *L. crenatus* (Borradaile), and *L. nanus* (Henderson), exhibits little if any difference in the morphological structure of the dactyls of the pereopods (rounded, flattened, with or without longitudinal sulci). The second, and apparently divergent group, which includes *L. thompsoni*, *L. foresti* sp. nov., and *L. nodulosus* sp. nov., manifests substantial morphological differences between the dactyl of the 3rd left pereopod (markedly broader and conspicuously concave) and the dactyls of the remaining ambulatory legs. Frequently the dorsal surface of the propodus of the left 3rd also is flattened and the lateral face somewhat concave. Nonetheless, patterns of routine variation such as the armature of these pereopods are similar between species of each group. For example, in the first group, the armature of the carpi varies from a complete row of dorsal spines on the carpus of each pereopod to a complete row only on the right 2nd in *L. lacertosus*. A comparable pattern is seen in *L. thompsoni*, a member of the second group.

Key to species of *Lophopagurus*

1. Carpi of 2nd (at least right) and often also 3rd pereopods each with row of spines posterior to spine at dorsodistal angle 2
- Carpi of 2nd and 3rd pereopods without row of spines posterior to spine at dorsodistal angle [2nd occasionally with 1 (rarely 2) posterodorsal spine(s)] 4
2. Dactyls and propodi of left 2nd and 3rd pereopods distinctly different (in

- lateral view, segments of 3rd appreciably shorter and broader, lateral face of dactyl conspicuously concave) *L. thompsoni*
- Dactyls of left 2nd and 3rd pereopods not distinctly different (in lateral view, segments of 3rd not appreciably shorter and broader, lateral face of dactyl not conspicuously concave) 3
3. Dorsal surface of dactyl and fixed finger of right chela with distinct small spines, spinules, or tubercles *L. lacertosus*
- Dorsal surface of dactyl and fixed finger of right chela each with row of large, partially coalesced tubercles *L. crenatus*
4. Lateral face of dactyl of left 3rd pereopod flat or rounded (with or without longitudinal sulcus) *L. nanus*
- Lateral face of dactyl of left 3rd pereopod concave 5
5. Dorsal surface of palm of right chela with spinules or small tubercles; dorsolateral surface of palm of left chela spinulose or tuberculate *L. foresti*
- Dorsal surface of palm of right chela with large nodule-like tubercles; dorsolateral surface of palm of left chela unarmed *L. nodulosus*

Lophopagurus thompsoni (Filhol, 1885) s.s.

Figure 2

Eupagurus thompsoni Filhol, 1885a: 33 (in part). — 1885b: 423 (in part), pl. 51 fig. 6 (? in part), not fig. 7, see remarks. — Alcock, 1905: 176 (in part), see remarks. — McLaughlin, 1981a: 3 (in part), see remarks.

Not *Pagurus thompsoni* Bell, 1851: 372, unnumbered figure (= *Pagurus bubescens* Krøyer).

Eupagurus thompsoni. — Thomson, 1898: 183 (in part), see remarks.

? *Eupagurus thompsoni*. — Thompson, 1930: 270, see remarks.

Pagurus thompsoni. — Jordan, 1956: 336 (in part, see remarks). — Forest, 1961: 223.

Pagurus thomsoni. — Forest, 1961: 223.

Pagurus lacertosus. — Forest, 1961: 223.

Not *Pagurus lacertosus* (Henderson), see remarks.

Pylopagurus thompsoni. — Forest and de Saint Laurent, 1967: 145. — McLaughlin, 1981a: 3 (in part), see remarks.

Pylopagurus sp. "mauve antenna 1". — Probert et al., 1979: 381 (list), 385.

Lophopagurus thompsoni. — McLaughlin, 1981a: 3 (by implication) (in part), see remarks.

Pagurus n. sp. (aff. *thompsoni*). — Rainer, 1981: 37.

Lophopagurus "thompsoni". — Schembri, 1982: 870, fig. 9. — Schembri and McLay, 1983: 30, figs 8a, b. — Probert and Wilson, 1984: 389 (list). — Schembri, 1988: 93. — Taylor et al., 1989: 1064.

Type material. Lectotype (herein designated): Cook Strait, New Zealand, MNHN (female syntype, total length = 14 mm, not examined).

Other material. New Zealand: RV *Tangaroa*, NZOI stn R94 (37°37.9'S, 176°27.0'E), 44–47 m, 21 Jan 1979, NMNZ Cr7414 (4 males, 3.8–5.1 mm). RV *Acheron* stn BS 531 (40°52'S, 172°04'E), 64 m, 10 Mar 1976, NMNZ Cr8242 (2 males, 3.0, 6.4 mm). RV

Acheron stn BS 514 (40°57.5'S, 174°01.5'E), 29 m, 5 Mar 1976, NMNZ Cr8329 (1 male, 7.4 mm). RV *Acheron* stn BS 542 (41°08'S, 174°33.5'E), 282–293 m, 12 Mar 1976, NMNZ Cr7413 (7 males, 4 females, 3.6–9.1 mm). USNS *Ehanin* stn 25/368 (43°16'S, 175°23'E), 84 m, 19 Nov 1966, USNM 244449 (3 males, 1 female, 2 ovigerous females, 3.8–6.5 mm). USNS *Eltanin* stn 25/369 (43°17'S, 175°23'E), 95 m, 19 Nov 1966, NHRM 16678, RMNH D 40428 (2 males, 1 female, 1 ovigerous female, 5.0–7.1 mm). USNS *Eltanin* stn 25/370 (43°22'S, 175°20'E), 95 m, 19 Nov 1966, USNM 244448 (1 ovigerous female, 6.3 mm). Walls of Pegasus Canyon (43°25'S, 173°26'E) 183 m, 21 Feb 1979, NMNZ Cr4914 (2 males, 1 female, 1 ovigerous female, SL 5.1–7.7 mm). USNS *Eltanin* stn 23/1709 (43°31'S, 176°10'W), 143–183 m, 24 May 1966, USNM 244447 (1 male, 5.0 mm). Kaikoura (3 mi off shore), 30–60 m, 24 Jan 1967, NMNZ Cr3863 (10 males, 17 females, 4.1–10.6). Bay-mouth Bar, Deep Bay, Tory Channel, 3 m, 10 Oct 1989, NZCD Cr19 (1 male, 2 ovigerous females, 4.9–8.4 mm). RV *Tangaroa* NZOI stn B 556, SE Banks Peninsula (44°00.0'S, 173°47.5'E), 179 m, 6 Oct 1962 (1 male, 1 ovigerous female, 7.4, 8.4 mm). Port Chalmers, ZMUU, (1 male, 6.8 mm).

Redescription. Shield length equal to width or slightly longer than broad; anterior margin between rostrum and lateral projections concave; posterior margin truncate; dorsal surface with few scattered tufts of setae. Rostrum triangular, acute, usually without terminal spinule. Lateral projections broadly rounded, with small marginal or submarginal spine.

Ocular peduncles $\frac{1}{2}$ – $\frac{2}{3}$ length of shield; dorsal surface with tuft of stiff setae at base of slightly inflated cornea. Ocular acicles acutely and narrowly triangular, with small submarginal spine; separated basally by slightly less to slightly more than basal width of 1 acicle.

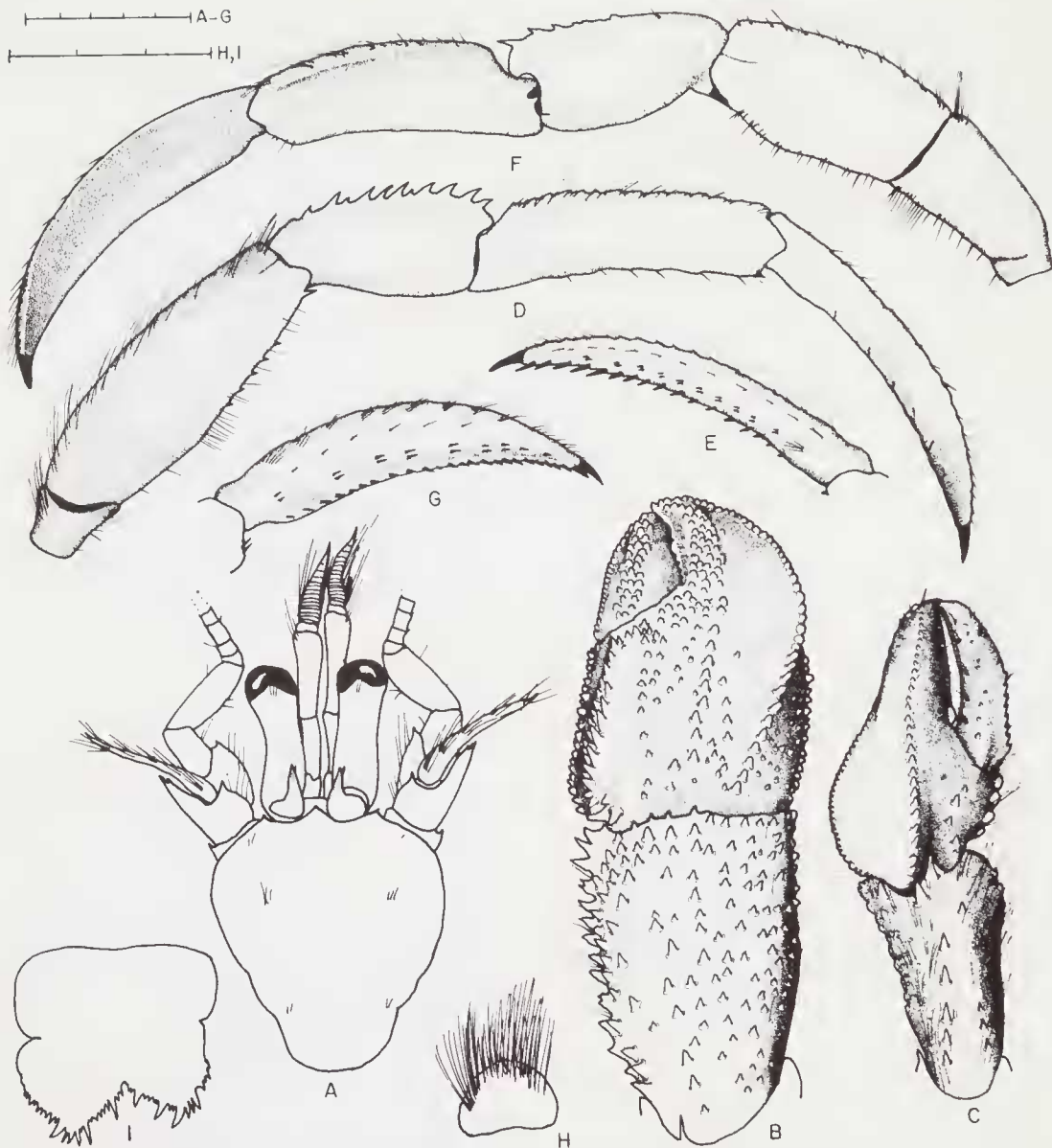


Figure 2. *Lophopagurus thompsoni* (Filhol), male from Pegasus Canyon, New Zealand, NMNZ Cr4914. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view), C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, dactyl of right 2nd pereopod (mesial view); F, left 3rd pereopod (lateral view); G, dactyl of left 3rd pereopod (mesial view); H, anterior lobe of sternite of 3rd pereopods; I, telson. Scales = 5 mm (A-G) and 3 mm (H, I).

Antennular peduncles overreach ocular peduncles by $\frac{1}{2}$ – $\frac{3}{4}$ length of ultimate segment. Ultimate segment with tuft of setae at dorsodistal margin laterally.

Antennal peduncles overreach ocular peduncles by $\frac{1}{3}$ – $\frac{1}{2}$ length of ultimate segment. Fifth

and fourth segments with scattered setae. Third segment with acute spine at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in strong spine, 1–5 accessory spines and/or spinules on mesial and lateral margins; dorsomesial distal angle with

acute spine, mesial margin with few setae. Basal segment with small spine on laterodistal angle. Antennal acicle reaching nearly to distal margin of cornea and terminating in strong spine, mesial margin with row of tufts of setae. Antennal flagellum long, but rarely overreaching tip of right cheliped; usually every 2nd or 3rd article with 1 or 2 very short setae and occasionally 1 or 2 slightly longer setae every several articles.

Right cheliped with daetyl somewhat triangular in cross-section; as long or slightly longer than palm and overlapped by fixed finger; cutting edge with row of calcareous teeth of varying size, terminating in corneous claw; dorsal surface with irregular rows of low tubercles, dorsomesial margin depressed ventrally and armed with row of tubercles, sometimes rather indistinct; ventral surface with 1 or 2 rows of tufts of moderately long setae. Palm $\frac{1}{2}$ – $\frac{2}{3}$ length of carpus; dorsomesial margin depressed, dorsomesial component almost perpendicular, delineated above by tubercular or spinose ridge indistinctly continuous with broad ridge of tubercles adjacent to cutting edge of fixed finger; dorsal surface with scattered tubercles (sometimes only obscurely apparent) or small spines and with row of stronger spines or tubercles in midline, dorsolateral margin with row of acute or blunt spines on palm, often appearing as very closely-spaced tubercles on fixed finger; lateral face convex and spinulose or tuberculate on palm, ventral surface weakly tuberculate. Carpus as long or slightly longer than merus; dorsomesial margin with double row of acute spines proximally, becoming single marginal and medially oblique rows distally, dorsal surface with numerous small spines or tubercles, distal margin with several spines, dorsolateral margin not distinctly delimited; mesial face concave and with few low tubercles near distal margin, frequently also with low transverse ridges and tufts of setae; lateral face weakly tuberculate, ventrolateral margin with row of low tubercles, ventral surface with few low tubercles. Merus with acute spine at dorsodistal margin and frequently 2 or 3 additional spines in distal third, often accompanied by transverse rows of tufts of setae; mesial and lateral faces with transverse rows of long setae, occasionally with few tubercles or spinules ventrally, ventrolateral margin with row of spines, more acute in distal half; ventral surface with few low tubercles and tufts of setae, ventromesial margin with row of small spines, occasionally practically obscured by tufts of long setae. Ischium with few small

spines or spinules on ventromesial margin and tufts of long setae.

Left cheliped triangular in cross-section; propodal-earpal articulation usually in horizontal plane. Daetyl $2\frac{1}{4}$ –3 times length of palm; cutting edge with row of corneous teeth, terminating in small corneous claw and slightly overlapped by fixed finger; dorsomesial margin with row of small spines or tubercles in proximal half, dorsal surface with 1 or 2 rows of tufts of setae and occasionally few small tubercles or spinules in midline. Palm $\frac{1}{3}$ – $\frac{1}{2}$ length of carpus; markedly elevated in midline to prominent median crest armed with single row of very closely-spaced tubercles or with row of small spines, dorsolateral margin erenulate or tuberculate, sloping to ventral position on fixed finger, dorsolateral surface usually unarmed on palm but usually with few tubercles on fixed finger, dorsomesial surface of palm with few spines or tubercles, dorsomesial margin with row of tubercles. Carpus slightly shorter than merus and broadened distally; dorsolateral margin with row of moderately strong spines and tufts of long setae, row of somewhat smaller spines and tufts of setae on dorsomesial margin; lateral face with scattered, low, sometimes spinulose protuberances and numerous tufts of long setae, 1 or 2 prominent spines at or near distal margin; mesial face with scattered tufts of setae and few tubercles on distal margin; ventral surface with low protuberances, tubercles or small spines and tufts of setae. Merus with transverse, sometimes spinulose ridges and long setae on dorsal surface primarily in distal half; ventromesial and ventrolateral margins each with row of spines, sometimes becoming exceptionally strong proximally, and tufts of dense setae. Ischium with row of small spines or spinules on ventromesial margin partially obscured by tufts of short setae.

Right and left 2nd and right 3rd pereopods similar. Daetyls slightly longer than propodi; in dorsal view, slightly twisted; in lateral view, slightly curved; terminating in small corneous claw; dorsal surfaces with low protuberances and tufts of setae, mesial faces each with dorsal and ventral row of corneous spinules, ventral margins each with 13–21 corneous spinules, lateral faces slightly convex and often with a row of short setae near ventral margin. Propodi $\frac{1}{4}$ – $\frac{1}{3}$ longer than carpi; dorsal surfaces with low protuberances and tufts of setae, ventral surfaces each with row of small corneous spinules partially obscured by tufts of setae, mesial and lateral faces each with row of short, widely-spaced

setae dorsally and ventrally. Carpi slightly shorter than meri, 2nd and frequently also 3rd each with row of spines on dorsal margin, strongest on 2nd right. Meri with low protuberances and tufts of setae on dorsal surfaces, ventrolateral margins each with row of spines (2nd) or weak to moderately well developed protuberances (3rd), all surfaces also with tufts of short to long setae. Ischia with tufts of setae on ventral margins. Left 3rd pereopod with dactyl, in dorsal view, more strongly twisted, lateral face markedly concave, unarmed, dorsal surface broad and flattened, dorsomesial and dorsolateral margins each with row of stiff bristles or thin corneous spinules, ventral margin with 17–23 short corneous spinules, mesial face convex and with single or double dorsal and ventral rows of corneous spinules. Propodus broad, lateral face flattened or slightly concave; dorsal surface with transverse rows of short setae, mesial face with dorsal and ventral rows of widely-spaced setae, ventral surface with row of small corneous spinules and transverse row of similar spinules at distal margin. Carpus, merus and ischium similar to 3rd right.

Anterior lobe of sternite of 3rd pereopods subrectangular to subsemicircular, anterior margin with long, thick setae. Fourth pereopod with small preungual process at base of claw. Telson with posterior lobes slightly asymmetrical, terminal margins oblique, each with few strong spines and numerous smaller spines extending onto lateral margins.

Colour. "Eyestalks orange-red proximally tending to pale blue distally, antennules pale blue or mauve; antennae strongly barred dark red-brown and white; chelipeds orange-red with longitudinal reddish stripes and white areas around the joint region, especially that between carpopodite and meropodite; walking legs orange-red with longitudinal reddish stripes and white areas around the joint regions." (Schembri and McLay, 1983)

Distribution. Southern New Zealand; subtidal to 293 meters.

Affinities. *Lophopagurus thompsoni* is most closely related to, and has often been confounded with, *L. foresti* sp. nov. There are only subtle differences in the armature of the right cheliped in the two species, and intraspecific variations make these differences unreliable as diagnostic characters. Both species also are similarly coloured, particularly the longitudinally-striped ambulatory legs. The armature of the

pereopods, particularly the carpi of the 2nd and frequently also the 3rd, and the dactyl of the left 3rd afford immediate separation of the two species. The carpi of the 2nd pereopods, at least the right, of *L. thompsoni* have a full row of spines on the dorsal surface. The 3rd pereopods often are similarly armed, although the spines are smaller and may be fewer in number; however, these spines occasionally are represented only by spinulose protuberances or may be entirely absent. The ventral margin of the dactyl of the 3rd left pereopod is armed with 21–23 small corneous spinules. The dorsolateral surface of the palm of the left chela is usually smooth. In contrast, the carpi of the 2nd pereopods in *L. foresti* are provided with a single dorsodistal spine; occasionally 1, or very rarely 2, additional spine(s) may develop in the proximal half of the dorsal surface. Only a single dorsodistal spine is present on the carpi of the 3rd pereopods. The ventral margin of the dactyl of the 3rd left pereopod is armed with 11–16 corneous spinules. The dorsolateral surface of the palm of the left chela most frequently is tuberculate at least proximally. *L. thompsoni* is also generally similar in appearance to *L. lacertosus*. Again the pereopods, particularly the 3rd left, provide distinguishing characters. In *L. thompsoni* there is a marked difference between the 2nd and 3rd left pereopods. The dactyl of the 3rd is appreciably shorter, broader, and has a conspicuously concave lateral face. Additionally, the ventral margins of the dactyls of both 2nd and 3rd pereopods are armed with short corneous spinules. In *L. lacertosus*, the 2nd and 3rd pereopods are generally similar in size and conformation, although there is a tendency in females for the lateral face of the dactyl of the 3rd left to become slightly concave; the ventral margins of the dactyls are armed with considerably longer spinules, particularly in the distal fourth.

Remarks. Filhol (1885a) published his first description of *Eupagurus thompsoni* in a relatively unknown account of the crustacean fauna of New Zealand. This initial description was brief and lacked illustrations. In a subsequent report published later that same year, Filhol (1885b) repeated the cryptic description, but provided an illustration of the whole animal (pl. 51 fig. 6). It is his description in the "Mission de l'Île Campbell" that is most frequently cited as the original. In this report, the figure legends for plate 51 state that figure 7 is also an illustration of the left chela of *E. thompsoni* but this clearly is incorrect. The illustrated appendage bears no

resemblance to that depicted for the whole animal. Filhol's whole animal illustration is also inaccurate in showing no abdominal pleopods.

Filhol (1885a) confounded two species under the name *thompsoni*; his figure (1885b, pl. 51 fig. 6) seems to be a composite of both. At least three syntypes of Filhol's taxon exist. The first, representing one of the species, is represented in the collections of the Muséum National d'Histoire Naturelle, Paris (Forest, 1961; pers. comm.). A second syntype, representing the second species, (USNM 22927) part of a gift from E.-L. Bouvier in 1899 (cf. Manning and Holthuis, 1981), is in the collections of the National Museum of Natural History, Smithsonian Institution. A third syntype (RMNH 1661), also representing the second species, is in the collections of the Nationaal Natuurhistorisch Museum, Leiden. During their work with New Zealand pagurids, Forest and de Saint Laurent (unpublished) provided illustrations, descriptions and working keys to New Zealand carcinologists, and it is upon these data that subsequent local faunal and systematic studies have been based (e.g., Schembri and McLay, 1983; Probert and Wilson, 1984; Schembri, 1988). Consequently, it is deemed most appropriate, and in the interest of stability in nomenclature, that the specimen from the Muséum National d'Histoire Naturelle, Paris, be selected as the lectotype of *Eupagurus thompsoni* Filhol. The remaining two syntypes represent an undescribed species. The specimen from the U.S. National Museum of Natural History (USNM 22927) is designated the holotype of this second species, *Lophopagurus foresti* sp. nov.

We have not had the opportunity to examine the lectotype of *E. thompsoni* directly because of its present poor condition; however, J. Forest has meticulously compared it with specimens from the New Zealand Oceanographic Institute, currently in Paris, and two of these latter specimens (1 male, 8.4 mm and 1 ovigerous female, 7.4 mm) from NZOI stn B 556 have been provided for our examination.

Thomson (1898) repeated Filhol's (1885b) description of "*Eupagurus thompsoni*" (sic), but indicated that he had no personal knowledge of this species. His report, therefore, referred to both of the taxa confounded by Filhol (1885a, b). It would appear that Thomson's (1898) report was the first introduction of the second spelling attributed to Filhol's species.

Alcock (1905) merely presented a list of species; however, in citing both Filhol (1885b)

and Thomson (1898) as references to the species, he also was referring to both taxa.

Chilton (1911) noted that while the specimens he identified as *Eupagurus thompsoni* agreed with Filhol's (1885b) short description, the carpus of the right cheliped was not nearly as spiny as Filhol's figure would suggest. We have reexamined Chilton's (1911) four specimens from "Nora Niven" stns 5 and 17 (CMC) and found that while they do agree with one of the two taxa confounded by Filhol under the name *thompsoni*, they are referable to *L. foresti* sp. nov.

Thompson (1930) provisionally referred a series of specimens to *Eupagurus thompsoni*, including those identified by Chilton. Thompson remarked on the variability of his specimens and noted that in many particular points his specimens seemed closer to *L. crenatus* (Borradaile). Since Thompson did not describe the configuration and armature of the pereopods, it is impossible, without first hand examination, to know what taxa were actually represented. Thompson's specimens have yet to be examined.

Gordan's (1956) bibliography of pagurids listed both *Pagurus thompsoni* and *P. thompsoni*. The former name she attributed to no author, but implied its synonymy with *Pagurus pubescens* Krøyer. Her citations for *P. thompsoni* (Filhol, 1885) include authors who were referring to both *P. thompsoni* Bell and *P. thompsoni* (Filhol).

Eupagurus thompsoni Filhol became a secondary junior homonym when the International Commission for Zoological Nomenclature placed *Eupagurus* on the Official Index of Rejected and Invalid Generic Names in Zoology (ICZN, 1957; Hemming, 1958). Forest, in Pike (1961), pointed out that Filhol's (1885a) specific name *thompsoni*, also spelled *thomsoni* by Forest was preoccupied by *Pagurus thompsoni* Bell (1853). In his discussion, Forest stated that he had compared Pike's (1961) parasitized specimen with Filhol's type in the Paris museum and had found them identical. However, he also thought that both agreed with Henderson's (1888) description of *Eupagurus lacertosus* and because Filhol's name was preoccupied, *Pagurus lacertosus* was the correct name. As previously noted, *L. thompsoni* and *L. lacertosus* bear a superficial resemblance to one another; however, the two are distinct taxa, a conclusion also subsequently reached by Forest (pers. comm.). Although *lacertosus* is not available as a replacement name for *thompsoni*, the need for

such a name no longer exists. Forest and de Saint Laurent (1967) transferred both *P. thompsoni* and *P. lacertosus* to *Pylopagurus*; McLaughlin (1981a) placed them in *Lophopagurus*. According to ICZN Art. 59(c) "If, in the case of secondary homonymy, the junior species-group name has not been replaced [Art. 60], and the taxa in question are no longer considered congeneric, the junior name is not to be rejected...". Clearly Bell's and Filhol's species cannot be considered congeneric, therefore Filhol's specific name, *thompsoni* is retained.

McLaughlin (1981a) was unaware that Filhol had confounded two species under the name *thompsoni* when she designated *Eupagurus thompsoni* as the type species of *Lophopagurus*. At the time, her interpretation of Filhol's species was based, in part, on the photographs provided by J. Forest and M. de Saint Laurent, and in part on the syntype from the National Museum of Natural History (USNM 22927). The generic diagnosis of *Lophopagurus* was made from a review of the four species assigned at the time, i.e., *Pylopagurus thompsoni* sensu lato, *P. lacertosus*, *P. nanus*, and *P. crenatus*. Designation of *P. thompsoni* as the type species was an arbitrary decision, thus misinterpretation of the type species, in the meaning of ICZN Art. 70, presents no problem.

Lophopagurus foresti sp. nov.

Figures 1A,C, E, 3

Eupagurus thompsoni Filhol, 1885a: 33 (in part); 1885b: 423 (in part), pl. 51 fig. 6 (? in part), not fig. 7. — Alcock, 1905: 176 (in part). — McLaughlin, 1981a: 3 (in part), see remarks under *L. thompsoni*.

Eupagurus thomsoni. — Thomson, 1898: 183 (in part). — Chilton, 1911: 298; see remarks under *L. thomsoni*.

Pagurus thompsoni. — Gordan, 1956: 336 (in part), see remarks under *L. thompsoni*.

Pylopagurus thompsoni. — McLaughlin, 1981a: 3 (in part), see remarks under *L. thompsoni*.

Lophopagurus thompsoni. — McLaughlin, 1981a: 3 (by implication) (in part), see remarks under *L. thompsoni*.

Type material. Holotype: Cook Strait, New Zealand, USNM 22927 (male, 5.3 mm).

Paratypes: RV *Acheron* stn BS 389, between Three Kings Islands and North Cape (34°21'S 172°37'E), 58 m, 19 Feb 1974, NMNZ Cr8181 (1 male, 2.0 mm). West end Great Island, Three Kings Islands, G. Hardy and A. Stewart, 3–7 m, 28 Nov 1983, NMNZ Cr8036 (1 male, 2.5 mm). RV *Tangaroa* NZOI stn R 90 (37°46.5'S, 176°38.5'E), 39 m, 21 Jan 1979, NMNZ Cr8330 (1 male, 5.0 mm). RV *Acheron* stn BS 490

(39°57'S, 174°34'E), 33–35 m, 2 Mar 1976, NMNZ Cr8331 (6 males, 2.9–5.2 mm). Cook Strait, New Zealand, RMNH 1661 (1 male, 4.4 mm). RV *Acheron* stn BS 488 (40°09.5'S, 174°36'E), 82 m, 2 Mar 1976, NMNZ Cr4911 (4 males, 2 females, 2.4–4.1 mm). Wellington Harbour, M. Davidson, 19 m, 17 Apr 1980, NMNZ Cr4109, 4113 (3 male, 6 females, 5.0–7.9 mm); M. Davidson, 17 m, 7 May 1980, NMNZ Cr4110 (1 male, 7.2 mm). RV *Acheron* stn BS 511 (40°46'S, 173°52.5'E), 18 m, 5 Mar 1976 NMNZ Cr8332 (1 male, 5.2 mm). RV *Acheron* stn BS 541 (40°46.5'S, 173°57'E), 59–64 m, 11 Mar 1976, NMNZ Cr8333 (1 male, 7.6 mm). RV *Acheron* stn BS 531 (40°52'S, 172°04'E), 64 m, 10 Mar 1976, NMNZ Cr8334 (1 male, 6.7 mm). RV *Acheron* stn BS 500 (40°57'S, 174°18'E), 139–144 m, 3 Mar 1976, NMNZ 7396 (1 male, 1 female, 4.8, 5.8 mm, female with rhizocephalan). RV *Acheron* stn BS 514 (40°57.5'S, 174°01.5'E), 29 m, 5 Mar 1976, NMNZ Cr8335 (3 males, 1 female, 3.9–7.7 mm). RV *Acheron* stn BS 504 (40°59.5'S, 174°08'E), 18–22 m, 4 Mar 1976, NMNZ Cr8336 (1 male, 1 female, 5.2, 7.2 mm). Bushette Shoal, Kaikoura, 56 m, R. Pilgrim, 14 Nov 1964, NMNZ Cr4111 (1 intersex, 6.6 mm). USNS *Ethanin* stn 16/1431 (45°37'S, 170°58'E), 51 m, 23 Feb 1965. USNM 244457, 244460. NHRM type colln 4371 (12 males, 8 females, 2.9–6.6 mm). *Nora Niven* stns 5 (50 mi. E of Wreck Reef) and 17 (8 mi. NE of Cape Saunders), 117 m, 102–192 m, 13, 25 Jun 1907, CM (3 males, 1 female, 4.8–6.5 mm).

Description. Shield longer than broad; anterior margin between rostrum and lateral projections concave; posterior margin truncate. Rostrum triangular, acute, often terminating in small spinule. Lateral projections broadly rounded, usually with strong marginal or submarginal spine.

Ocular peduncles $\frac{2}{3}$ – $\frac{3}{4}$ length of shield; dorsomesial face with row of tufts of setae. Ocular acicles slender, terminating acutely and with strong submarginal spine; separated basally by width of rostrum, or slightly less than basal width of 1 acicle.

Antennular peduncles when extended usually exceeding ocular peduncles by $\frac{1}{3}$ – $\frac{1}{2}$ length of ultimate segment, occasionally not overreaching cornea. Ultimate segment with tuft of long setae near distal margin and often row of widely-spaced, short setae on ventral surface. Penultimate segment usually glabrous. Basal segment with very strong, acute spine on lateral face dorsally, tuft of setae on mesial face.

Antennal peduncle usually reaching to extremity of cornea. Fifth and fourth segments with scattered setae. Third segment with acute spine at ventrodial angle usually obscured by tuft of long setae. Second segment with dorsolateral distal angle produced, terminating in acute

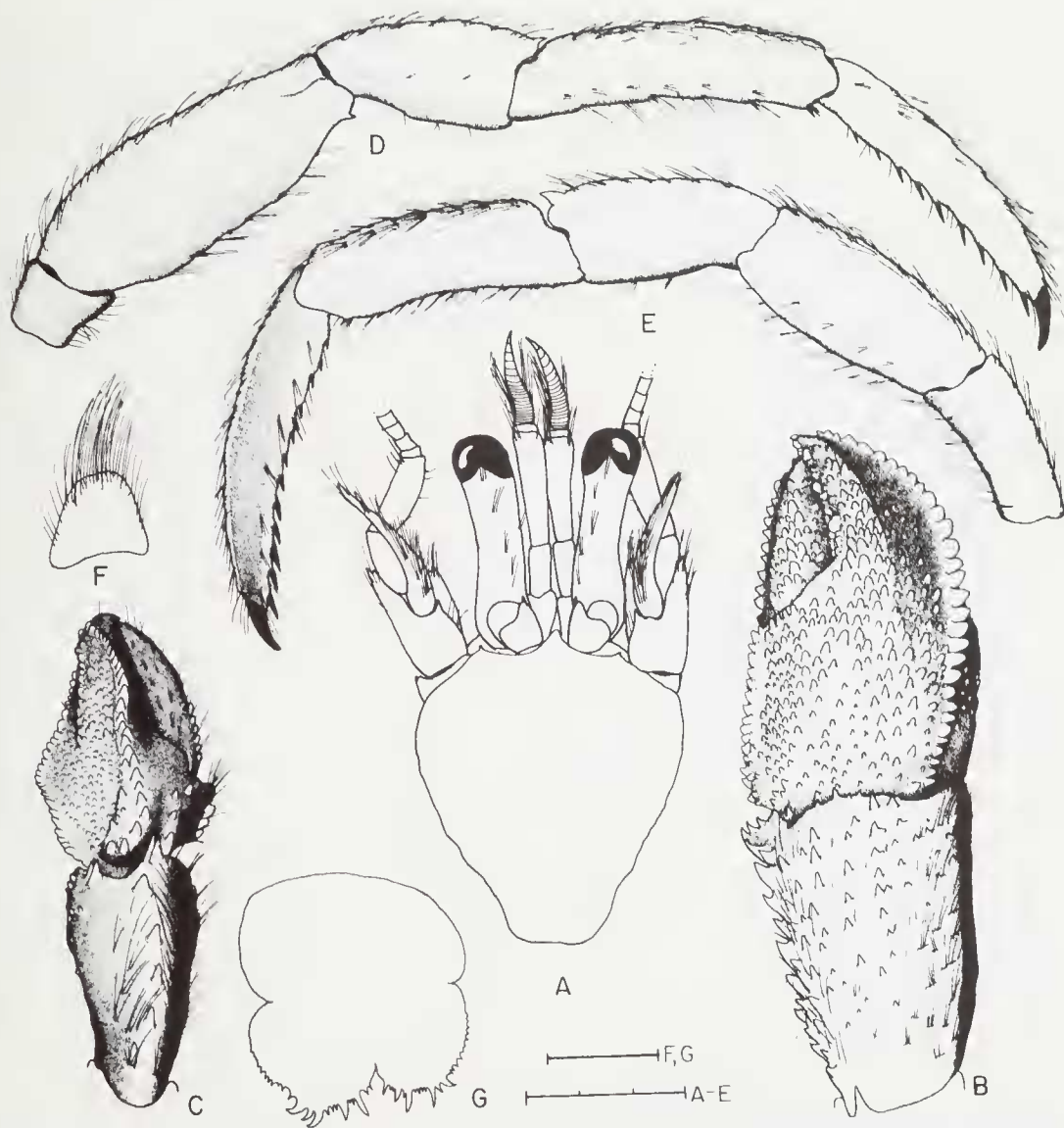


Figure 3. *Lophopagurus foresti* sp. nov. holotype, from Cook Strait, New Zealand, USNM 22927. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view), C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, left 3rd pereopod (lateral view); F, anterior lobe of sternite of 3rd pereopods; G, telson. Scales = 3 mm (A-E) and 1 mm (F, G).

spine, mesial and lateral margins with 1-3 accessory spinules and few setae; dorsomesial distal angle with acute spine, mesial face weakly setose. First segment with small spine on lateral face distally, ventral margin produced, with 1 spine distolaterally. Antennal acicle terminating in strong spine, mesial face with row of tufts of moderately long setae. Antennal flagellum sometimes overreaching right cheliped, with 1 very short seta each article and 2 slightly longer

(\gg 1 article length) setae every 2-4 articles in proximal half.

Right cheliped with dactyl slightly longer than palm; cutting edge with row of strong calcareous teeth in proximal $\frac{3}{4}$ - $\frac{4}{5}$, corneous teeth distally; terminating in corneous claw. Dorsal surface of dactyl elevated in midline and armed with irregular row of small to very strong spines or tubercles, dorsomesial and dorsolateral surfaces spinulose or tuberculate, dorsomesial margin

with row of small to large spines or tubercles. Palm slightly more than half length of carpus; dorsomesial margin with single or double row of small to large tubercles, dorsomesial component flat to strongly concave, weakly to strongly tuberculate, delineated dorsally by curved, tuberculate ridge extending to tip of fixed finger, dorsal surface covered with blunt spines or tubercles and with elevated ridge laterad of midline extending onto fixed finger, dorsolateral margin with large, compressed tubercles, sometimes becoming more spine-like on fixed finger; lateral face convex proximally and with scattered tubercles; ventral surface with scattered tufts of setae, longest and thickest on fixed finger and dactyl. Carpus approximately as long as merus; dorsomesial margin with irregular row of moderately strong spines, dorsal surface with single or double row of tubercles mesial of midline, sometimes only weakly tuberculate and with low, transverse, sometimes spinulose ridges and tufts of setae laterally, distal margin with 3–5 small spines, dorsolateral margin not delimited; ventrolateral margin with row of small blunt spines distally, sometimes only crenulate; mesial face often with 1–3 spines or tubercles on distal margin; ventral surface with few low tubercles and scattered tufts of setae. Merus with strong, acute spine on dorsodistal margin; ventromesial margin with row of blunt spines in proximal half and 1 or 2 spinules distally; ventral surface with few blunt spines or tubercles, ventrolateral margin with row of spines, strongest and most acute distally. Ischium with row of spines or spinules on ventromesial margin and occasionally 1 acute spine on lateral face ventrally.

Left cheliped usually not reaching beyond base of dactyl of right; propodal-carpal articulation in horizontal plane. Dactyl 2–4 times longer than palm; overlapped by fixed finger and sometimes with small hiatus proximally; cutting edge with row of corneous teeth; terminating in strong corneous claw. Dorsal surface of dactyl unarmed but often with row of tufts of setae near dorsomesial margin and second near cutting edge, dorsomesial margin with few blunt spines or tubercles proximally. Palm $\frac{1}{4}$ – $\frac{1}{3}$ length of carpus, midline with prominent elevated crest armed with single row of simple or corneous-tipped spines or tubercles extending almost to tip of fixed finger, dorsolateral face spinulose or tuberculate, dorsolateral margin with blunt tubercles proximally often becoming corneous-tipped spines distally, margin markedly depressed ventrally on fixed finger, dorsomesial

face with few spinules, dorsomesial margin with row of 2–4 small spines. Carpus with single row of spines on dorsolateral margin and 2 or 3 spines on distal margin; lateral face with transverse ridges and tufts of setae, occasionally few spinules and 1 or 2 spines dorsally, distal margin with 1–3 prominent spines dorsally and sometimes also few smaller spines; mesial face with short, transverse rows of tufts of setae, occasionally also with 1 small spine on distal margin dorsally and few low protuberances ventrally; ventral surface with tufts of setae and frequently several small spines or tubercles. Merus with row of tufts of setae on dorsal margin; ventromesial margin with row of spines, strongest in proximal third, ventrolateral margin with row of spines, strongest in distal half. Ischium with row of blunt spines on ventromesial margin and frequently small spine on laterodistal margin ventrally.

Ambulatory legs often overreaching right cheliped; left 3rd pereopod dissimilar; all terminating in strong corneous claws. Dactyls of 2nd pereopods and 3rd right $\frac{1}{4}$ – $\frac{1}{3}$ longer than propodi; dorsal surfaces each with row of stiff setae, ventral margins each with 9–13 corneous spines, mesial faces each with row of corneous spinules near dorsal margin and row of stiff bristles or bristle-like corneous spinules near ventral margin. Propodi each with 2 corneous spinules at ventrodorsal angle and row of spinules on ventral surface, dorsal and ventral surfaces also with rows of stiff setae. Carpi each with strong dorsodistal spine and sometimes 1 additional spine in proximal half (2nd right, occasionally also 2nd left) and tufts of long setae. Meri each with row of tufts of setae on dorsal margin, 2nd with row of spines on ventrolateral margin (at least left) and 1 acute spine at ventrolateral distal angle, 3rd unarmed, but with tufts of setae. Ischia unarmed. Third left pereopod with lateral surface of dactyl conspicuously concave, ventral surface broad, with outer margin frequently thickened and occasionally with small calcareous nodules developed, row of 11–16 strong, corneous spines on inner margin, mesial face with double row of corneous spines dorsally and additional single or double row ventrally. Propodus with lateral surface somewhat flattened, ventral surface with row of corneous spinules and 1 corneous spine at ventrodorsal angle. Carpus with single dorsodistal spine and tufts of setae on dorsal surface. Merus with tufts of setae on dorsal and ventral margins.

Anterior lobe of sternite of 3rd pereopods subsemioval to subsemicircular, anterior margin

with long setae. Fourth pereopod with small preungual process at base of claw. Telson with numerous small spines and few stronger spines on terminal margins extending on to lateral margins.

Colour. (In preservative 4 years): Antennal flagella alternately banded reddish brown (4–7 articles) and translucent or white (2 or 3 articles). Right cheliped with 2 longitudinal orange stripes on the dorsal surface of the palm, 1 extending onto fixed finger and second at the cutting edge, 1 additional at the dorsodistal margin of the dactyl. Left cheliped with longitudinal orange stripe on the dorsolateral face of the left chela. Ambulatory legs with 4 longitudinal orange stripes visible in lateral view on the propodi, carpi and meri and 1–3 on dactyls.

Etymology. This species is dedicated to Professor Jacques Forest in recognition of his contributions, not only to our knowledge of the New Zealand hermit crab fauna, but to the hermit crab fauna of the world.

Distribution. Northern, central and south-eastern New Zealand; 18–192 m.

Affinities. *L. foresti* is very similar to *L. thompsoni*. However, it may be distinguished from the latter species by the carpi of the ambulatory legs, which carry only single spines at the dorsodistal margins of the carpi, or occasionally an additional (or very rarely 2) spine(s) posteriorly on the 2nd. The small number of corneous spinules (11–16) on the ventral margin of the dactyl of the 3rd left pereopod in *L. foresti* will also usually separate it from *L. thompsoni*. *Lophopagurus foresti* also bears considerable similarity to *L. nanus*; however, the distinct difference between the dactyls of the left 2nd and 3rd pereopods, (3rd with markedly concave lateral face) will immediately distinguish *L. foresti* from *L. nanus*, a species in which the configurations of the dactyls are all similar.

Remarks. A single, apparently “intersex”, specimen from Bushette Shoal, Kaikoura, NZ (NMNZ Cr4111) was observed with male pleopods, a single female gonopore and no gonopods. There was no external indication of parasitism.

Lophopagurus nodulosus sp. nov.

Figure 4A–H

Pylopagurus crenatus. — Probert et al., 1979: 381. Not *Pylopagurus crenatus* (Borradaile) (see remarks).

Lophopagurus sp. nov. — Schembri, 1982: 870.

Lophopagurus n. sp. — Schembri and McLay, 1983: 30. figs 9a, b. — Schembri, 1988: 93.

Type material. Holotype: North side Punui Bay, Snares Island, New Zealand, 50 m, 24 Feb 1976, NMNZ Cr8347 (male, 6.4 mm).

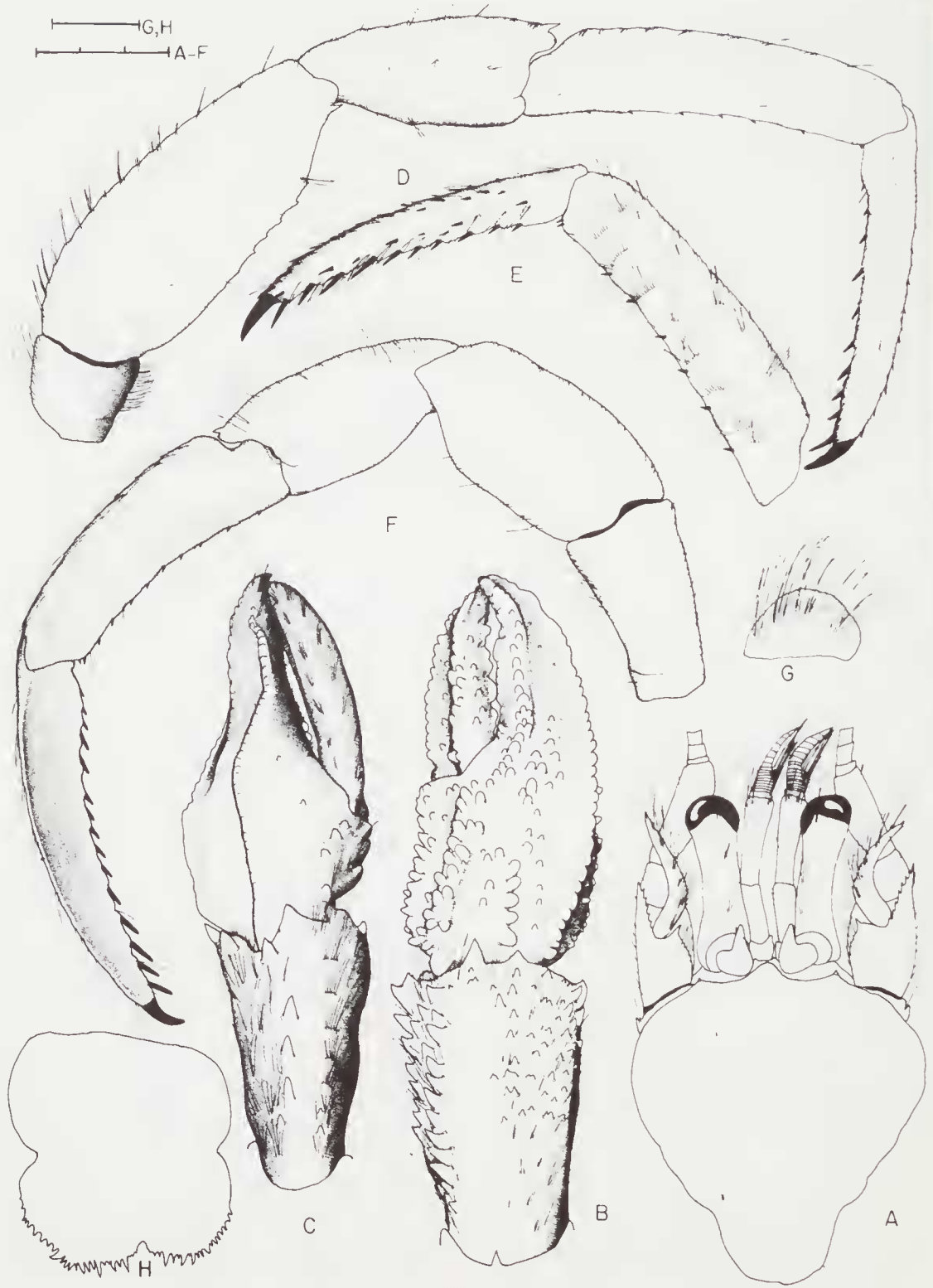
Paratypes: North side Punui Bay, Snares Island, New Zealand 50 m, 24 Feb 1976, NMNZ Cr4912 (1 male, 5.9 mm); 50 m, 24 Feb 1979, Cr7397 (4 males; 1 female, 3.3–7.4 mm). USNS *Eltanin* stn 25/370 (43°22'S, 175°20'E), 95 m, 19 Nov 1966, USNM 244458 (1 male, 6.9 mm). USNS *Eltanin* stn 51/590 (52°08.5'S, 169°43.7'E), 90–91 m, 20 Jan 1972. USNM 244454 (1 male, 2.5 mm). USNS *Eltanin* stn 25/368 (43°16'S, 175°23'E), 84 m, 19 Nov 1966, USNM 244443, NHRM type colln 4372, RMNH D 40429 (2 males, 1 female, 1 ovigerous female, 5.0–7.4 mm). Perseverance Harbour, Campbell Island, 11 m, K. Westerskov, 12 Feb 1985, NMNZ Cr4867 (1 male, 6.7 mm). Proclamation Island, Bounty Islands, D.S. Horning, 38 m, 8 Nov 1978, NMNZ Cr8197 (9 males, 10 females, 2 ovigerous females, 3.4–6.7 mm).

Description. Shield longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins terraced or sloping; posterior margin truncate; dorsal surface with few scattered tufts of setae. Rostrum bluntly triangular, with very minute terminal spinule. Lateral projections broadly rounded, with moderately well developed submarginal spine.

Ocular peduncles $\frac{3}{4}$ – $\frac{4}{5}$ shield length; corneae slightly dilated; dorsomesial surface with row of tufts of setae, Ocular acicles narrowly triangular, with strong, but not elongate, submarginal spine; separated basally by slightly less than basal width of 1 acicle.

Antennular peduncles when extended overreach ocular peduncles by $\frac{1}{4}$ – $\frac{1}{3}$ length of ultimate segment. Ultimate segment with few scattered setae and tuft of setae at dorsolateral distal angle. Penultimate segment with few scattered setae. Basal segment with acute spine laterally.

Antennal peduncles only slightly overreaching ocular peduncles. Fifth and fourth segments with scattered setae. Third segment with small spine at ventral margin obscured by tuft of setae. Second segment with dorsolateral distal angle produced, terminating in strong spine, mesial margin with 2–5 accessory spines, lateral margin with 1 or 2 accessory spines; dorsomesial distal angle with acute spine, mesial face with tufts of setae. First segment with small spine at dorsolateral distal angle, ventral margin produced and with 1 spine laterally. Antennal acicle reaching beyond base of cornea and sometimes overreaching cornea; slightly arcuate and terminat-



ing in strong spine, mesial margin with tufts of stiff setae. Antennal flagellum not overreaching right cheliped; articles each with 1–3 minute setae and 1 or 2 slightly longer (\ll 1 article length) every 2nd to 5th article, at least in proximal half.

Right cheliped with dactyl only slightly longer than palm; cutting edge with 3 or 4 calcareous teeth and short distal row of corneous teeth; terminating in small corneous claw and slightly overlapped by fixed finger. Dorsomesial margin of dactyl with closely-set, blunt spines proximally becoming more spine-like distally, dorsal surface with raised row of prominent tubercular nodules and few scattered low tubercles; mesial and ventral surfaces with scattered tufts of stiff setae. Palm half length of carpus; dorsomesial margin with ridge of blunt or spinulose tubercles, dorsomesial component concave, surface with numerous tubercles, delimited above by elevated tubereulate ridge; dorsal surface of palm with very prominent ridge of tubercles or nodules in midline and similar row of tubercles extending length of fixed finger, remaining surface of palm with numerous large tubercles, remaining surface of fixed finger concave and armed only with few very small tubercles, dorsolateral margin with row of spines, becoming more tubereulate on fixed finger; lateral face convex, with 1 or 2 irregular rows of tubercles dorsally and low protuberances ventrally. Carpus slightly longer than merus; dorsomesial margin with double row of spines marginally and adjacent oblique row, dorsal surface with numerous tufts of setae, 1 or 2 rows of spines in midline and scattered spines or spinules particularly laterad of midline, dorsolateral margin delimited only by irregular row of transverse, spinulose ridges and tufts of setae; lateral face with scattered tufts of setae and few blunt spines on distal margin dorsally, ventrolateral margin with row of protuberances, tubercles or spines; mesial face concave, unarmed but with numerous tufts of setae. Merus with acute spine at dorsodistal margin, dorsal surface with transverse ridges and tufts of setae, extending onto lateral and mesial faces in distal half; ventrolateral margin with row of tubercles proximally, becoming acute spines distally, ventral surface

with few scattered tubercles, ventromesial margin with row of spines or spinulose tubercles. Ischium with tufts of setae on ventromesial margin.

Left cheliped reaching to base of dactyl of right or slightly beyond; propodal-carpal articulation approximately in horizontal plane. Dactyl 2–3 times length of palm; terminating in corneous claw and slightly overlapped by fixed finger; cutting edge with row of corneous teeth; dorsomesial margin with few low spinules or tubercles in proximal third, dorsal, mesial and ventral surfaces with rows of tufts of setae. Palm $\frac{1}{4}$ length of carpus; midline very strongly elevated into crest composed of fused tubercles presenting scalloped appearance, usually continuing to tip of fixed finger, dorsolateral margin crenulate proximally, becoming row of weak spines on fixed finger, dorsolateral surface smooth or slightly pitted and with low tuberculate ridge in proximal half of fixed finger, dorsomesial face of palm with few tubercles, dorsomesial margin with 3 spinulose lobes. Carpus approximately equaling length of merus; dorsolateral margin with row of strong spines, dorsomesial margin sometimes with 1 or 2 spines proximally and row of tufts of long stiff setae, 1 strong, acute spine on dorsodistal margin; mesial face with low, transverse ridges and tufts of setae; laterodistal margin with 1 strong and 1–3 smaller spines; ventral surface and ventrolateral and ventromesial margins all with tufts of setae. Merus with row of stiff setae on dorsodistal margin and tufts on setae on dorsal surface; ventromesial margin with 2 prominent, blunt spines in proximal half and 1 or 2 smaller spines in distal half, ventrolateral margin with row of acute spines. Ischium with tufts of setae on ventromesial margin.

Second pereopods and 3rd right similar; in dorsal view, slightly twisted; in lateral view, very slightly curved ventrally; terminating in strong, corneous claws. Dactyls slightly longer than propodi; dorsal surfaces slightly flattened, dorsomesial margins each with row of corneous spinules and tufts of long, stiff setae, dorsolateral margins with tufts of stiff setae, mesial faces each with partial or complete row(s) of corneous spinules and tufts of stiff setae dorsally and ventrally

Figure 4. *Lophopagurus nodulosus* sp. nov., male paratype from *Eltanin* stn 25/370, USNM 244455. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view); C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, dactyl of right 2nd pereopod (mesial view); F, left 3rd pereopod (lateral view); G, anterior lobe of sternite of 3rd pereopods; H, telson. Scales = 3 mm (A–F) and 1 mm (G, H).

(2nd) or complete row(s) of corneous spinules and tufts of setae (3rd); ventral margins each with 10–12 corneous spinules, lateral faces with scattered tufts of setae. Propodi $\frac{1}{3}$ – $\frac{2}{3}$ longer than carpi; with low protuberances and tufts of long stiff setae on dorsal surfaces, ventral surfaces each with row of corneous spinules, mesial faces each with row of tufts of setae dorsally and ventrally. Carpi approximately $\frac{2}{3}$ length of meri; each with low protuberances and tufts of setae on dorsal surface and single dorsodistal spine, rarely with second dorsal spine in proximal half (2nd). Meri with dorsal and ventral tufts of long setae, each also with acute spine at ventrolateral distal angle and 1–4 spines on ventral surface (2nd) or unarmed (3rd). Ischia with tufts of long, stiff setae on dorsal and ventral margins. Third left pereopod with dactyl $\frac{1}{5}$ – $\frac{1}{4}$ longer than propodus; in dorsal view, straight; in lateral view, slightly curved ventrally; dorsal surface flattened, dorsolateral margin often broadly scalloped and with row of tufts of stiff setae and partial row of corneous spinules distally, lateral face markedly concave, ventral margin often tuberculate, with row of 12–15 corneous spines; mesial face sometimes with slight longitudinal sulcus proximally and dorsal and ventral rows of corneous spinules. Propodus slightly longer than carpus; dorsal surface flattened, lateral face flat or slightly concave, unarmed, dorsal surface with rows of tufts of long stiff setae, ventral surface with row of corneous spinules and tufts of long setae, mesial face with transverse rows of tufts of setae and 1 or 2 corneous spinules on distal margin ventrally. Carpus, merus and ischium similar to right 3rd pereopod.

Sternite of 3rd pereopods with anterior lobe subsemicircular. Fourth pereopod with small preungual process at base of claw. Posterior lobes of telson with terminal margins level to oblique, armed with several strong spines interspersed with smaller spines, lateral margins spinulose.

Colour. "Eystalks reddish; antennules uniform pale reddish-orange; antennae reddish with narrow white bands; chelipeds and walking legs, reddish-orange ground colour with darker bands." (Schembri and McLay, 1983).

Distribution. South-eastern New Zealand, Campbell and Bounty Islands; 11–400 m.

Etymology. From the Latin *nodus*, meaning knotty or knobby, and referring to the nodular appearance of the armature of the right chela.

Affinities. *Lophopagurus nodulosus* is closely allied to *L. foresti* sp. nov. but is easily separated from that species by the distinctive nodules, rather than spines and tubercles on the dorsal surface of the right chela.

Remarks. In a benthic community study, Probert et al. (1979) listed *Pylopagurus crenatus* (Borradaile) among the species occurring on the continental shelf and upper continental slope off the Otago Peninsula of south-eastern New Zealand. Schembri and McLay (1983), in their annotated key to the hermit crabs of the Otago region, equated Probert et al.'s (1979) *P. crenatus* to their *Lophopagurus* n. sp. We have not seen Probert et al.'s material; however, McLay (pers. comm.) has confirmed the conspecificity of the material.

Schembri and McLay (1983) reported both *Lophopagurus thompsoni* and *Lophopagurus* n. sp. The distribution of the former species was given as continental shelf (<200 m) and occasionally intertidal, that of the latter restricted to the upper and deep canyon regions (>200 m). The specimen of *L. nodulosus* from Campbell Island was collected from a much more shallow depth (11 m).

Lophopagurus crenatus (Borradaile, 1916)

Figure 5

Eupagurus crenatus Borradaile, 1916: 95, fig. 8. — Thompson, 1930: 270.

Pagurus crenatus. — Gordan, 1956: 328.

Pylopagurus crenatus. — Forest and de Saint Laurent, 1967: 145. — McLaughlin, 1981a: 3.

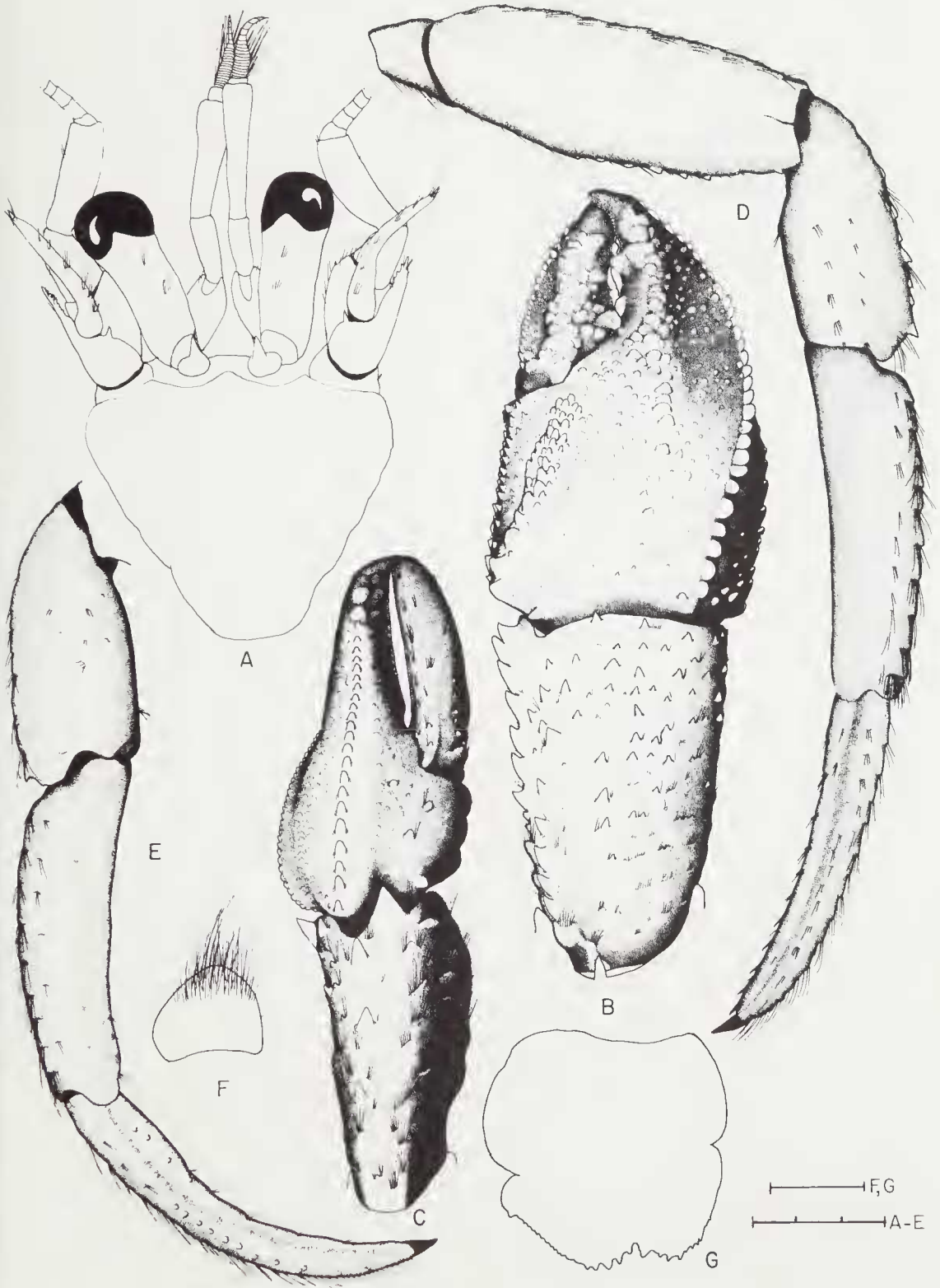
Lophopagurus crenatus. — McLaughlin, 1981a: 3 (by implication).

Not *Pylopagurus crenatus.* — Probert et al., 1979: 381 (= *Lophopagurus nodulosus* sp. nov.).

Type material. Holotype: New Zealand, "Terra Nova" stn 90, "From summit, Gt. King, Three Kings Islands, S. 14°W., 8 miles, 183 metres (100 fathoms.), July 25, 1911." BMNH 1917.1.29.134 (male, 5.8 mm).

Other material. None.

Figure 5. *Lophopagurus crenatus* (Borradaile), holotype, from off Three Kings Islands, New Zealand, BMNH 1917.1.29.134. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view), C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, left 3rd pereopod (lateral view); F, anterior lobe of sternite of 3rd pereopods; G, telson. Scales = 3 mm (A–E) and 1 mm (F, G).



Redescription. Shield slightly broader than long. Rostrum bluntly triangular, without terminal spinule. Lateral projections obtusely triangular, with submarginal terminal spinule.

Ocular peduncles $\frac{3}{4}$ shield length, moderately stout and with corneae somewhat dilated, few tufts of setae on dorsal surface. Ocular acicles narrowly triangular, terminating acutely and with strong submarginal spine; separated basally by basal width of I acicle.

Antennular peduncles when extended overreaching ocular peduncles by $\frac{1}{4}$ length of ultimate segment.

Antennal peduncles overreaching ocular peduncles by at least $\frac{1}{4}$ length of ultimate segment. Fifth and fourth segments each with few scattered setae. Third segment with small spine at ventrodistal margin. Second segment with dorsolateral distal angle strongly produced and terminating in strong spine, mesial margin with 5 or 6 small spinules, dorsomesial distal angle with strong spine. First segment with small spine and/or tuft of setae at lateral margin distally, ventral margin produced and with 1 acute spine laterally.

Right cheliped with dactyl slightly less than length of palm, appreciably overlapped by fixed finger, terminating in small corneous claw; dorsomesial margin with row of moderately small tubercles, dorsal surface strongly elevated in midline and with numerous broad, sometimes coalesced tubercles. Palm approximately $\frac{2}{3}$ length of carpus; dorsomesial component sloping, delimited dorsally by prominent tuberculate ridge, surface slightly concave and with few small spinules or tubercles, dorsomesial margin with double row of small spines, dorsal surface of palm and fixed finger weakly tuberculate but with prominent tuberculate ridge extending nearly entire length of fixed finger, dorsolateral margin with row of strong, denticulate tubercles; lateral face with scattered tubercles and setae. Carpus with almost double row of strong spines on dorsomesial margin, dorsal surface with scattered small spines and tubercles, dorsolateral margin not delimited; lateral surface weakly tuberculate, ventrolateral margin with row of small spines increasing in size distally, ventromesial surface with low ridges and tufts of long setae. Merus with transverse rows of stiff setae on dorsal margin, dorsodistal margin with 1 strong spine; lateral face minutely tuberculate, ventrolateral margin with row of acute spines and tufts of setae, ventromesial margin with few moderately strong spines.

Ischium with row of small tubercles on ventromesial margin.

Left cheliped reaching beyond base of dactyl of right. Dactyl $2\frac{1}{2}$ times length of palm, dorsal surface with 2 or 3 tubercles on slightly elevated proximal midline, dorsomesial surface with few small tubercles dorsally and scattered setae. Palm strongly elevated in midline and armed with row of strong spines, decreasing in size on fixed finger and becoming low broad tubercles distally, dorsolateral face with low granules or minute tubercles, dorsolateral margin with small denticulate tubercles, dorsomesial surface with few granules or minute tubercles and few scattered stronger tubercles or blunt spines. Carpus subtriangular; dorsodistal margin produced into very strong spine in midline, dorsolateral margin with row of widely-spaced strong spines, dorsomesial margin and mesial face with transverse protuberances or low tubercles and tufts of setae; lateral face also with transverse ridges, more spinose in distal half and with strong spine on distal margin both dorsally and ventrally. Merus with tufts of stiff setae on dorsal surface; ventrolateral margin with row of strong, acute spines, lateral face with transverse ridges and tufts of setae, ventromesial margin with 3 subacute spines proximally, ventral surface with few spinules and tufts of setae. Ischium with row of blunt or spinulose tubercles and tufts of thick setae on ventral margin. Coxa with acute spine at ventromesial distal angle and smaller spine on ventrolateral margin distally.

Pereopods overreaching right cheliped by approximately $\frac{2}{3}$ length of dactyl, right slightly longer than left. Dactyls slightly longer than propodi; in lateral view, slightly curved ventrally; in dorsal view, twisted; left 3rd somewhat spatulate; dorsal surfaces each with single or double row of stiff setae, lateral faces each with longitudinal sulcus flanked by row of tufts of setae (2nd) or row of low tubercles at least dorsally (3rd), ventral margins each with row of strong, corneous spines, mesial faces each with longitudinal sulcus flanked dorsally by row of corneous spines and ventrally by row of setae (2nd, 3rd right) or row of corneous spinules (3rd left). Propodi with transverse rows of low protuberances and tufts of setae dorsally, 2 corneous spines at ventrodistal margin and row of tufts of setae on ventral margin, mesial and lateral faces each with 1 or 2 rows of tufts of setae. Carpi with irregular row of small spines on dorsal surface (right 2nd) or single spine at dorsodistal margin (3rd) and tufts of stiff setae. Meri with row of

tulfs of stiff setae on dorsal margin, lateral face with acute spine near ventrodorsal margin and row of small spines on ventral margin (2nd) or unarmed (3rd). Ischia unarmed.

Sternite of 3rd pereopods with anterior lobe semisubcircular. Telson with terminal margins of posterior lobes rounded to slightly oblique, armed with blunt spines; lateral margins as spinulose or spinose plate.

Colour. Unknown.

Distribution. At present known only from Three Kings Islands, New Zealand; 183 m.

Affinities. *Lophopagurus crenatus* is morphologically very similar to *L. lacertosus* and perhaps may be synonymous with the latter species, as suggested by J. Forest and M. de Saint Laurent (pers. comm. to John Yaldwyn). The former species is known only from its holotype collected south-west of Three Kings Islands off the northern tip of New Zealand (c. 34.2°S). *Lophopagurus lacertosus* is a highly variable species, and in most morphological characters the holotype of *L. crenatus* falls within the range of these variations. However, none of the numerous specimens of *L. lacertosus* we have examined have exhibited the coalesced tuberculate armature of the dactyl and fixed finger of the right chela that is present in *L. crenatus*. In view of the striking development of tubercles seen in *L. nodulosus*, it is possible that this is truly a distinguishing character, therefore we prefer, at least for the present, to recognize *L. crenatus* as a distinct taxon. *Lophopagurus crenatus* is distinguished from *L. nanus* by the presence of a row of spines on the carpus of the 2nd right pereopod in the former species.

Remarks. In his description of the single male specimen collected during the "Terra Nova" expedition, Borradaile (1916) described the carpi of the pereopods as being armed with a single dorsodistal spine. An examination of the type has shown that to be inaccurate. The carpus of the right 2nd pereopod is armed with a row of spines.

As previously noted, Probert et al. (1979) mistook specimens of *L. nodulosus* sp. nov. as *L. crenatus*. Had Borradaile's (1916) description been more accurate regarding the armature of the carpus of the right 2nd pereopod or more detailed in a description of the shape of the dactyl of the 3rd left pereopod, these authors would undoubtedly have realized that their species was distinct from *L. crenatus*.

Lophopagurus lacertosus (Henderson, 1888)

Figure 6

Eupagurus lacertosus Henderson, 1888: 63, pl. 6 fig. 7. — Thomson, 1898: 178 (in part, see remarks). — Sayce, 1902: 153. — Grant (in Sayce), 1902: 155. — Alcock, 1905: 175. — Zarenkov, 1967: 182 (in part), see remarks.

Pagurus lacertosus. — McCulloch, 1913: 346. — Gordan, 1956: 311 (in part), see remarks.

? *Pagurus* cf. *lacertosus*. — Yaldwyn, 1975: 361.

Pylopagurus lacertosus. — Forest and de Saint Laurent, 1967: 145. — McLaughlin, 1981a: 3.

Lophopagurus lacertosus. — McLaughlin, 1981a: 3 (by implication).

Not *Eupagurus lacertosus*. — Pope, 1947: 131, unnumbered figs 3, 4. — Dakin et al., 1948: 209, 219. — 1953: 199, pl. 44 fig. 7. — 1960: 199, pl. 44 fig. 7 (= *Pagurixus jerviensis* McLaughlin and Haig, 1984).

Not *Pagurus lacertosus*. — Griffin, 1967: 306. — Healy and Yaldwyn, 1970: 72, fig. 35 (= *Pagurixus jerviensis* McLaughlin and Haig, 1984).

Not *Pagurus lacertosus*. — Forest, 1961: 223 [= *Lophopagurus thompsoni* (Fihlhol)].

? Not *Pagurus lacertosus*. — Liszka and Underwood, 1990: 47 (? = *Pagurixus jerviensis* McLaughlin and Haig, 1984), see remarks.

Type Material. Lectotype herein selected: Type locality, HMS "Challenger" stn 166, off New Zealand, BMNH 88:33 (male 9.6 mm).

Other Material. RV *Tangaroa*, NZOI stn R 81 (37°35.9'S, 176°59.5'E), 139–179 m, 20 Jan 1979, NMNZ Cr8243 (1 female, 2.3 mm). USNS *Eltanin* stn 24/2718 (38°22'S, 169°07'W), 531–656 m, 12 Jul 1966, USNM 244461 (9 males, 1 female, 2 ovigerous females, 4.3–9.2 mm). Challenger Plateau (39°14'S, 169°27'E), 560–572 m, 21 Sep 1976, NMNZ Cr4905 (1 male, 6.9 mm). RV *Acheron* stn BS 519, Cook Strait Narrows (41°02'S, 174°33'E), 186–256 m, 6 Mar 1976, NMNZ Cr4908 (1 female, 2.2 mm). Off Cape Turakirae (41°30.2'S, 174°52'E), 658 m, 11 Dec 1974, NMNZ Cr7527 (1 male, 7.8 mm). RV *Tangaroa* NZOI stn R 27, SE of Cape Campbell (41°55.8'S, 174°40.7'E), 434–446 m, 14 Jan 1979, NMNZ Cr4907 (1 ovigerous female, 6.6 mm). RV "James Cook" stn J22/60/70, off Greymouth (42°27'S, 170°36'E), 440–460 m, 23 Nov 1970, NMNZ Cr4909 (6 males, 2 females, 5.0–11.8 mm). RV *Acheron* stn BS 433, Tairaroa Trench off Otago Peninsula, A.J. Black, 723–769 m, 11 Aug 1974, NMNZ Cr4902 (1 male, 5 ovigerous females, 4.7–6.9 mm). RV *Acheron* stn BS 558, head of Pegasus Canyon (43°30'S, 173°31.5'E), 446 m, 27 Sep 1976, NMNZ Cr4906 (2 males, 1 female, 4.1–9.0 mm). RV *Acheron* stn BS 549, head of Karitane Canyon (45°38.5'E, 171°05'E), 530–585 m, 19 Mar 1976, NMNZ Cr4904 (1 female, 4.4 mm). RV "Mmida" stn 76/139, Papanui Canyon NE of Tairaroa Head (45°46'S, 171°03'E), 660 m, 1 Sep 1976, NMNZ Cr8170 (1 male, 5.7 mm). USNS *Eltanin* stn 33/2145 (49°07'S,

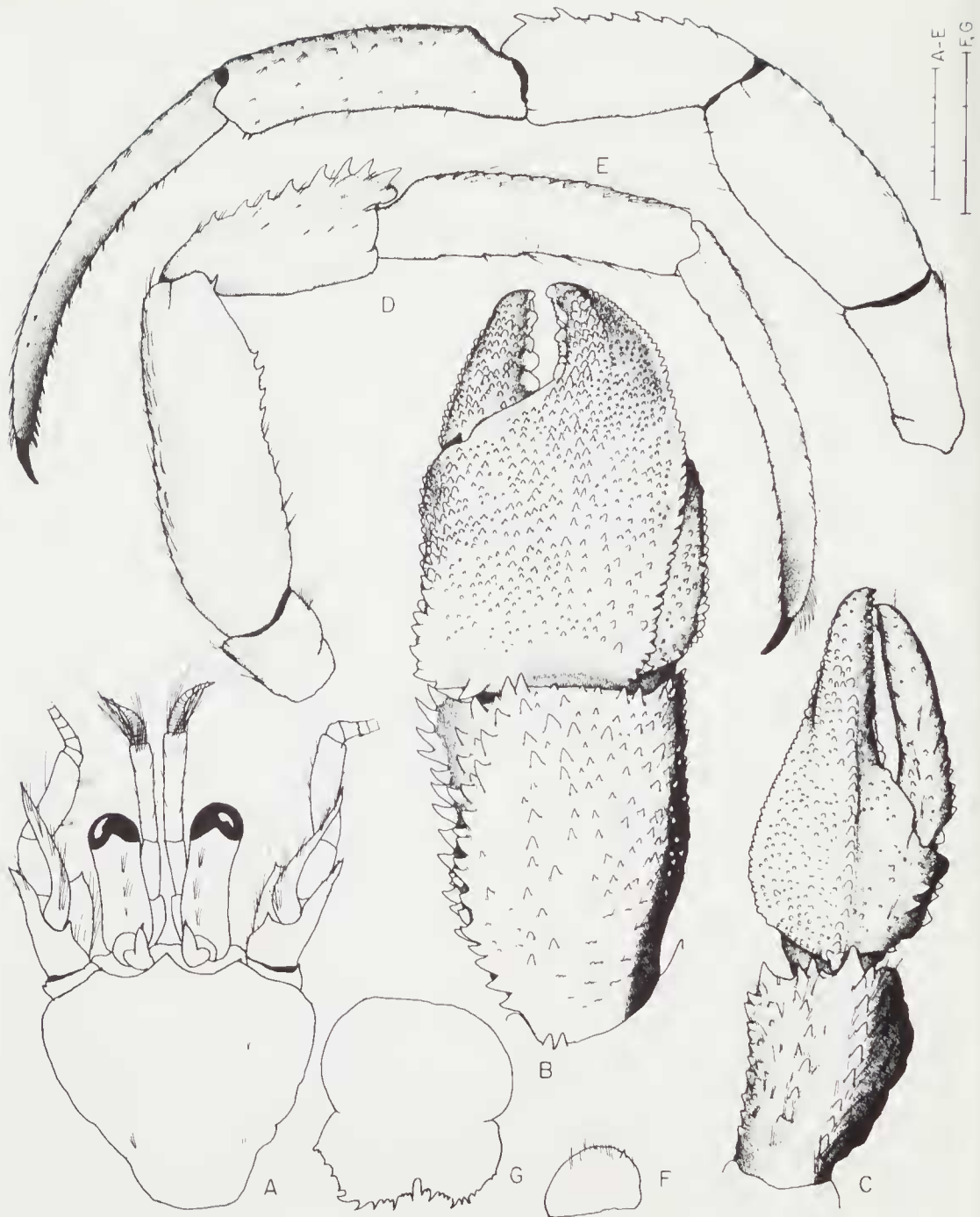


Figure 6. *Lophopagurus lacertosus* (Henderson), lectotype, from *Challenger* stn 166, off New Zealand, BMNH 88:33. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view); C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, left 3rd pereopod (lateral view); F, anterior lobe of sternite of 3rd pereopods; G, telson. Scales = 5 mm (A-E) and 3 mm (F, G).

172°00'E), 384–397 m, 23 Mar 1968, NHRM 16679, RMNH D 40427 (4 males, 3 females, 4.7–7.2 mm). USNS *Eltanin* stn 16/1426 (51°05'S, 166°22'E), 428–439 m, 19 Feb 1965, USNM 244452 (1 male, 6.0 mm). East Campbell Is. Rise (51°47'S, 168°19'E), 687–695 m, 19 Jan 1977, NMNZ Cr4903 (1 male, 1 ovigerous female, 6.2, 7.6 mm). USNS *Eltanin* stn 32/1989 (53°29'S, 169°48'E), 589–594 m, 1 Jan 1968, USNM 244454 (1 male, 3 females, 4.9–5.9 mm).

Redescription. Shield slightly broader than long to longer than broad; anterior margin between rostrum and lateral projections concave. Rostrum obtusely triangular, acute or bluntly rounded, sometimes terminating in minute spinule. Lateral projections broadly rounded, with 1 or occasionally 2 submarginal spinules.

Ocular peduncles $\frac{1}{2}$ – $\frac{2}{3}$ length of shield, moderately stout, with corneae slightly dilated; dorsomesial surface with row of tufts of setae. Ocular acicles narrowly and acutely triangular, with strong submarginal spine; separated basally by slightly less to slightly more than basal width of 1 acicle.

Antennular peduncles overreach ocular peduncles by almost entire length of ultimate segment. Ultimate segment with tuft of setae at dorsodistal margin and 2 rows of widely-spaced tufts of setae on dorsal surface.

Antennal peduncles overreach ocular peduncles by $\frac{1}{2}$ – $\frac{2}{3}$ length of ultimate segment. Fifth and fourth segments with scattered tufts of setae. Third segment with strong spine at ventrodistal angle. Second segment with dorsolateral distal angle produced and terminating in strong spine, mesial margin with 2 to several small spines; dorsomesial distal angle with strong spine. First segment with small spine at laterodistal margin. Antennal acicle considerably longer than ocular peduncles, reaching beyond proximal half of ultimate peduncular segment. Antennal flagella usually not overreaching right cheliped; 1–3 very short setae every 1 to several articles.

Right cheliped with dactyl slightly shorter to slightly longer than palm. Dactyl triangular and slightly elevated in midline, dorsal surface often covered with low, sometimes spinulose protuberances or tubercles, less prominent in large males; dorsomesial margin with row of closely-spaced small tubercles. Palm $\frac{3}{4}$ – $\frac{4}{5}$ length of carpus; dorsomesial margin depressed and armed with single or double row of small spines or tubercles, dorsomesial component weakly concave, armed with low, blunt or spinulose tubercles and delimited dorsally by moderately broad spinulose or tuberculate ridge; dorsal surface often covered with low, blunt or spinulose

tubercles, sometimes only granules, occasionally almost smooth, dorsal midline with single or double row of somewhat stronger spines, spinules or tubercles; fixed finger with narrow to broad ridge of blunt or spinulose tubercles near cutting edge and frequently also small spinules or tubercles on dorsal surface laterally; dorsolateral margin with row of blunt or acute spines or tubercles, lateral surface convex or angular, often covered with blunt to spinulose tubercles or granules and frequently with 1 stronger row of tubercles, also scattered tufts of setae. Carpus slightly longer than merus; dorsomesial margin with double or triple row of strong spines becoming widely divergent in distal half, dorsal midline with 1 or 2 rows of acute, smaller spines, dorsal surface laterad of midline with numerous small spines or spinulose tubercles, distal margin with few spines; lateral face spinulose or tuberculate and with tufts of setae, ventrolateral margin with row of blunt or acute spines or tubercles. Merus with 1 or 2 strong spines at dorsodistal margin, dorsal surface with transverse rows of long setae, extending onto lateral and mesial faces; ventrolateral margin with row of acute spines, ventromesial margin with 2 or 3 spines in proximal half. Ischium with row of small spines on ventromesial margin, laterodistal margin with small spine and tufts of setae ventrally.

Left cheliped with dactyl $2\frac{1}{2}$ – $3\frac{1}{2}$ times longer than palm; dorsal surface of dactyl with 1 or 2 rows of tufts of setae and sometimes also low protuberances or tubercles in proximal half, dorsomesial margin unarmed or with row of small spines or spinulose tubercles in proximal half. Palm $\frac{1}{3}$ – $\frac{1}{2}$ length of carpus; strongly elevated in dorsal midline and armed with row of small spines or tubercles extending onto fixed finger, dorsolateral margin with closely-spaced, compressed tubercles, dorsolateral surface unarmed or with minute to moderately well-defined, blunt or spinulose tubercles, dorsomesial surface with scattered small spines or spinules, dorsomesial margin with row of broad, sometimes spinulose tubercles. Carpus slightly longer than merus; dorsolateral margin with row of spines, strongest at distal angle, dorsomesial margin usually with row of smaller spines and transverse rows of long setae; lateral face frequently spinulose dorsally and with 1 or 2 strong spines near distal margin, spinulose protuberances or small spines ventrally, ventrolateral margin with row of spinules or spines. Merus with row of tufts of stiff setae on dorsodistal margin, dorsal surface with several transverse rows of stiff setae

extending onto lateral and mesial faces; ventrolateral margin with row of strong acute spines, ventromesial margin with 2 or 3 strong spines in proximal half. Ischium with row of small spines on ventromesial margin; laterodistal margin sometimes with 1 spine ventrally obscured by tuft of setae.

Ambulatory legs generally similar from right to left, or dactyl of left 3rd slightly different. Dactyls in dorsal view strongly twisted; in lateral view, slightly curved ventrally; usually at least $1\frac{1}{2}$ times length of propodi; dorsal margins with transverse rows of stiff setae, mesial faces each with dorsal and ventral row of corneous spinules or stiff setae, ventral margins each with row of 11–21 corneous spinules; lateral faces often with median longitudinal sulcus and sometimes dorsal row of low protuberances in males, frequently lateral face slightly concave in females. Propodi slightly longer than carpi; dorsal surfaces with transverse, sometimes spinulose, ridges and tufts of setae, ventral surfaces with transverse ridges and short to long setae. Carpi $\frac{1}{2}$ – $\frac{2}{3}$ length of meri; dorsal surfaces of 2nd (occasionally only right) and frequently also 3rd each with row of strong spines, slightly less prominent on 3rd. Meri with transverse ridges and tufts of setae on dorsal surfaces, ventral margins each with row of spines, at least in distal half (2nd), or low protuberances (3rd) and tufts of setae. Ischia with tufts of setae on ventromesial margin.

Anterior lobe of sternite of 3rd pereopods subsemicircular, anterior margin with long setae and sometimes 1 or 2 small spinules. Fourth pereopod with small preungual process at base of claw. Telson with posterior lobes oblique or rounded, terminal margins with few strong spines and numerous smaller spines extending onto lateral margins.

Colour. Unknown.

Distribution. Eastern New Zealand from off Motuhora Island to Otago, western New Zealand and Tasman Sea, and Campbell Island; ? Auckland Island (Yaldwyn, 1975); 139–840 m.

Affinities. As indicated in the discussion of *L. crenatus*, given the ranges of variation of several morphological characters observed in *L. lacertosus* the possibility exists that this species is conspecific with, and the senior subjective synonym of, *L. crenatus*. The two taxa presently are distinguished by the armature of the dactyl and fixed finger of the right chela, which are armed

with spinules, small tubercles or small spines in *L. lacertosus* in contrast to a broad row of coalesced tubercles in *L. crenatus*.

Despite the fact that Henderson (1888) considered *L. lacertosus* morphologically very close to *L. nanus*, this species actually is more readily confused with *L. thompsoni*. *Lophopagurus thompsoni* shares distributional and morphological attributes with *L. lacertosus*. Both species have the carpi of the second, and usually also the third pereopods armed with a dorsal row of spines. *Lophopagurus nanus*, in contrast, has only one spine at the dorsodistal margin of these segments. *Lophopagurus lacertosus* is readily distinguished from *L. thompsoni* by the dactyl of the 3rd left pereopod. The dactyl of *L. lacertosus* is generally similar in size and shape to that of the left 2nd. The lateral surface is flattened, very faintly concave, or even convex and frequently is marked by a longitudinal sulcus in the proximal third. In *L. thompsoni* the dactyl of the left 3rd pereopod is short, broad and distinctly different from the 2nd; the lateral face is markedly concave.

Remarks. Henderson (1888) considered *L. nanus* to be only a dwarf variety of *L. lacertosus*, and for this reason in some subsequent reports, authors (e.g., Thomson, 1898; McCulloch, 1913; Zarenkov, 1967) combined the two taxa. Forest and de Saint Laurent (1967) elevated the former to full specific rank when they transferred it, together with *L. lacertosus*, to the genus *Pylopagurus*. We concur that both represent distinct taxa.

A common intertidal hermit crab found in and around Sydney, Australia has frequently been referred to as *Pagurus* (or *Eupagurus*) *lacertosus* (i.e., Pope, 1947; Dakin et al., 1948, 1953, 1960; Griffin, 1967; Healy and Yaldwyn, 1970). This species was recently described as *Pagurixius jerviensis* McLaughlin and Haig, a species bearing only gross similarities to Henderson's taxon (McLaughlin and Haig, 1984). Liszka and Underwood (1990), in a study of gastropod preference, state that their study animal was *Pagurus lacertosus*, a small crab abundant in the intertidal and subtidal habitats in the Sydney region. Acknowledgement for taxonomic identification is given to the Australian Museum and "Dakin (1953)" (for Dakin et al., 1953) is cited for ecological information. Their material was not deposited in the Australian Museum and consequently is not available for reexamination (P.B. Berents, pers. comm.). In view of the common misidentification that has so frequently

been made of one local intertidal species, we questionably assign Liszka and Underwood's (1990) taxon to *Pagurixus jerviensis*.

In his checklist of decapod and stomatopod Crustacea from the Auckland and Campbell Islands, Yaldwyn (1975) included *Pagurus* cf. *lacertosus* (Henderson), with the accompanying note that according to Pike (1961) *P. lacertosus* and *P. thompsoni* were synonymous. The identity of Yaldwyn's specimen(s) has not been determined; however, currently available distributional records do not indicate that *L. thompsoni* is found as far south as the Subantarctic, whereas *L. lacertosus* is.

Lophopagurus nanus (Henderson, 1888)

Figures 1B, D, F; 7

Eupagurus lacertosus var. *nana* Henderson, 1888: 64, pl. VII fig. 1. — Ortmann, 1892: 306. — Whitlegge, 1889: 231. — 1900: 169. — Alcock, 1905: 175.

Eupagurus lacertosus, var. *Nana*. — Grant (in Sayce), 1902: 155.

Pagurus lacertosus var. *nana*. — McCulloch, 1913: 346.

Pagurus nana. — Hale, 1927: 94, fig. 90.

Eupagurus lacertosus nana. — Hale, 1941: 279.

Pylopagurus nanus. — Forest and de Saint Laurent, 1967: 145. — McLaughlin, 1981a: 3.

Eupagurus lacertosus. — Zarenkov, 1967: 182 (in part) (see remarks).

Lophopagurus nanus. — McLaughlin, 1981a: 3 (by implication).

Type material. Syntypes: HMS "Challenger" stn 162, off East Monocour Island, Bass Strait, BMNH 88:33 (4 males, 1.8–3.3 mm; 1 female, 2.0 mm, 1 ovigerous female, 1.7 mm).

Other material. Australia, Qld, 20 mi NNE of Double Island Pt, AM E6277 (4 males, 6 ovigerous females, 1.5–2.6 mm). Off coast of NSW, 128 m, USNM 64543 (3 males, 1 female, 1 ovigerous female, 1.6–2.4 mm). HMAS "Kimbla" stn K7/73-57 (38°18.6' S, 146°40.8' E), 64 m, 25 Nov 1973, NMV J11761 (1 ovigerous female, 2.9 mm). HMAS "Kimbla" stn K7/73-62 (39°00.3' S, 146°45.9' E), 66 m, 26 Nov 1973, NMV J11383 (1 male, 4.1 mm). ¼ mi. off Newhaven, Western Port, Vic., T. Crawford, 6 Apr 1963, NMV J14597 (1 female, 1.9 mm). Simpsons Bay, Tasmania, 14–27 m, Jul 1926, USNM 64596 (1 male, 5.4 mm). Simpsons Bay, D'Entrecasteaux Channel (43°17.7' S, 147°18' E), M. Ward, 14–22 m, Aug 1926, AM P8652 (1 male, 5.0 mm). Southeast Australia, NMV J14595 (1 male, 5.1 mm).

Redescription. Shield longer than broad; anterior margin between rostrum and lateral projections concave; posterior margin truncate. Rostrum broadly triangular, usually without ter-

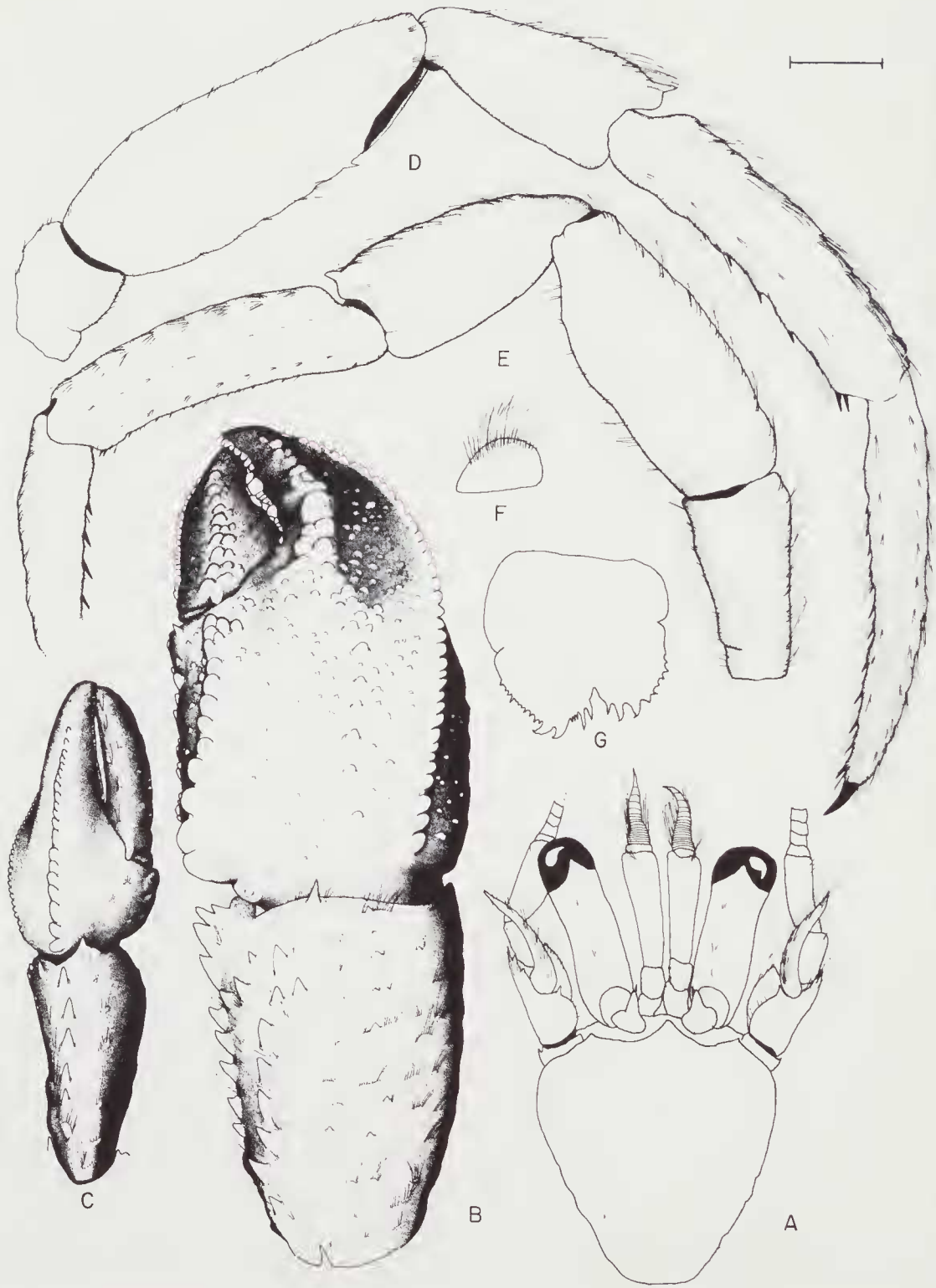
minal spinule. Lateral projections broadly rounded, with small terminal margin spinule.

Ocular peduncles $\frac{1}{2}$ – $\frac{2}{3}$ shield length, with corneae slightly inflated, dorsomesial face with row of tufts of stiff setae. Ocular acicles narrowly and acutely triangular, with moderately small submarginal spine; separated basally by slightly less to slightly more than basal width of 1 acicle.

Antennular peduncles when extended overreach ocular peduncles by $\frac{1}{2}$ – $\frac{2}{3}$ length of ultimate segment. Ultimate segment with tuft of setae adjacent to dorsodistal margin.

Antennal peduncles reaching to distal margin of corneae or slightly beyond. Fifth and fourth segments with few scattered setae. Third segment with small spine at ventrodistal margin, partially obscured by tuft of long, stiff setae. Second segment with dorsolateral distal angle produced, terminating in strong spine, mesial margin with 1–3 additional smaller spines, lateral margin usually with 1 additional spine and several long setae; dorsomesial distal angle with strong spine. First segment with spine at laterodistal margin. Antennal acicle reaching to distal margin of cornea or slightly beyond and terminating in strong spine; mesial margin with row of tufts of setae. Antennal flagellum with occasional short seta every several articles.

Right cheliped with dactyl slightly shorter than palm; terminating in corneous claw and slightly overlapped by fixed finger. Dorsal surface of dactyl with low, sometimes spinulose tubercles or protuberances and short setae, dorsomesial margin with row of small, sometimes spinulose tubercles, often becoming obsolete distally; mesial face and ventral surface with scattered tufts of setae. Palm $\frac{2}{3}$ – $\frac{3}{4}$ length of carpus; dorsomesial margin depressed and armed with single or double row of small spinules, dorsomesial segment often with weakly tuberculate surface, delimited above by single or double row of small spinules or spinulose tubercles, dorsal surface of palm weakly tuberculate and with row of spinules or tubercles laterad of midline, fixed finger with dorsal surface weakly tuberculate and with longitudinal, tuberculate ridge adjacent to cutting edge developing in larger specimens (SL >2.5 mm), dorsolateral margin of palm and fixed finger with row of small spines or spinulose tubercles often decreasing in size proximally; lateral face convex and weakly tuberculate or with transverse ridges and scattered short setae, ventral surface also weakly tuberculate. Carpus approximately equaling length of merus; dorsomesial margin with row of acute spines and adjacent second, oblique row of



slightly smaller spines, dorsodistal margin with 1 or 2 small spines, dorsal surface with additional 1 or 2 rows of spines laterad of midline and transverse rows of tufts of setae, extending onto lateral surface, dorsolateral margin not delimited; ventrolateral margin often with row of small spinules distally, ventral and mesial surfaces with scattered tufts of setae. Merus usually with 1 acute spine at dorsodistal margin, dorsal margin with transverse ridges and tufts of long setae, extending onto lateral and mesial faces; ventrolateral margin with row of acute spines, strongest distally, ventromesial margin with 2 or 3 spines in proximal half. Ischium frequently with 1 or 2 spines on ventromesial margin proximally.

Left cheliped with dactyl $2\frac{1}{2}$ –3 times length of palm, terminating in strong corneous claw, overlapped by fixed finger; surfaces of dactyl with scattered tufts of setae. Palm $3\frac{1}{4}$ – $3\frac{1}{2}$ times shorter than length of carpus; dorsal surface elevated in midline into prominent crest, armed with row of spines, becoming obsolete near tip of fixed finger, dorsolateral margin crenulate and depressed to ventral position distally on fixed finger, dorsolateral surface smooth, minutely tuberculate or with very low protuberances and tufts of setae, dorsomesial surface often with few low tubercles and numerous tufts of setae, dorsomesial margin with few low tubercles. Carpus approximately equaling length of merus; dorsal surface with somewhat oblique row of acute spines extending from dorsolateral margin proximally to dorsomesial margin distally, dorsomesial margin also often with 2 or 3 small spines or protuberances proximally, dorsodistal margin with 1 or 2 spines; mesial face with scattered tufts of setae; lateral face usually with 1 small spine on distal margin dorsally and 1 or 2 spines near distal margin ventrally, ventrolateral margin often with few small spinules or tubercles; ventral surface with numerous tufts of long setae. Merus with transverse ridges and tufts of long setae on dorsal surface and extending onto mesial and lateral faces; ventromesial margin with 1–3 blunt or acute spines proximally, ventrolateral margin with row of acute spines. Ischium usually with row of small spines on ventromesial margin.

Second and 3rd pereopods similar. Dactyls exceed length of propodi by $\frac{1}{4}$ – $\frac{1}{3}$ own length; each terminating in strong corneous claw; dorsal surfaces with tufts of thick, sometimes spine-like bristles, lateral faces each with median longitudinal sulcus and tufts of setae dorsally and ventrally, mesial faces each with row of corneous spinules dorsally and ventrally; ventral margins each with row of 8–15 corneous spines. Propodi exceeding carpi by $\frac{1}{3}$ – $\frac{1}{2}$ own length; ventral distal angles each with 2 or 3 corneous spinules and row of corneous spinules on ventral surface, dorsal surfaces with tufts of setae. Carpi $\frac{1}{2}$ – $\frac{3}{4}$ length of meri; dorsal surfaces with low protuberances and tufts of long setae, 1 or rarely 2 spines at dorsodistal margins. Meri with low protuberances and tufts of long setae on dorsal surfaces, ventral surfaces with tufts of setae or low protuberances proximally, often becoming small spinules distally (2nd) or with only tufts of setae (3rd). Ischia with tufts of setae dorsally and ventrally.

Sternite of third pereopods with anterior lobe subsemicircular, anterior margin with long setae. Fourth pereopod with small preungual process at base of claw. Telson with posterior lobes generally symmetrical; terminal margins oblique, each with 3 or 4 prominent spines and smaller spines extending onto lateral margins.

Colour. Unknown.

Affinities. *Lophopagurus nanus* is quite similar to *L. crenatus* in having a single row of spines on the carpus of the left cheliped. It differs from *L. crenatus* in lacking spines on the carpus of the 2nd right pereopod. *Lophopagurus nanus* also is superficially similar to *L. foresti*, but is immediately distinguished from that species by having the left 2nd and 3rd pereopods similar; the lateral face of the dactyl of the 3rd left is flattened or convex and often provided with a longitudinal sulcus. The left 2nd and 3rd pereopods of *L. foresti* are distinctly dissimilar; the lateral face of the dactyl of the 3rd is markedly concave.

Distribution. South-eastern Australia and Tasmania; 14–128 m.

Remarks. Halc (1927), without comment, elevated Henderson's var. *nana* to full specific rank

Figure 7. *Lophopagurus nanus* (Henderson), male syntype, from off East Moneoer Island, Bass Strait, Australia, BMNH 88:33. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view); C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, left 3rd pereopod (lateral view); F, anterior lobe of sternite of 3rd pereopods; G, telson. Scale = 1 mm (A–E) and 0.5 mm (F, G).

as *Pagurus nana*; however, in his later publication (Hale, 1941) he again cited this taxon as a subspecies of *L. lacertosus*. Although Henderson (1888) described *L. nanus* as having the characters of *L. lacertosus* and differing only in size, the two taxa do exhibit significant morphological differences. This fact was recognized by Forest and de Saint Laurent (1967) when they transferred both species to *Pylopagurus*.

Lophopagurus nanus is abundant in the waters off southern Australia, and is represented in the collections of the Museum of Victoria by several hundred lots. These lots have been examined by one of us (S.W. Gunn) but, in the interest of conciseness, are not listed under materials examined.

Australeremus McLaughlin, 1981

Eupagurus sensu lato. — Melin, 1939: 29 (in part, see remarks).

Pylopagurus. — Forest and de Saint Laurent, 1967: 145 (in part), not *Pylopagurus* Milne Edwards and Bouvier, 1891. — Miyake, 1978: 119 (in part). — McLaughlin, 1981a: 2 (in part) see remarks.

Australeremus McLaughlin, 1981a: 4. Type species, by original designation, *Eupagurus cookii* Fillhol. Gender masculine.

Diagnosis. Eleven pairs phyllobranch gills. Ocular acicles triangular, with well developed submarginal spine; separated basally by $\frac{1}{2}$ to entire basal width of 1 acicle. Sternite of 3rd maxillipeds usually with small spine or spinule on either side of midline. Basal antennular segment with strong lateral spine; ventrodistal margin produced into elongate lobe. Maxillule (Fig. 8A, B) with external lobe of endopod well developed, internal lobe with 1 or 2 terminal bristles. Maxilla with proximal lobe of scaphognathite narrow (Fig. 8C, D). First maxilliped (Fig. 8E, F) with exopod slender to slightly broadened basally. Third maxilliped with well developed crista dentata and very strong accessory tooth; merus with or without small spine at dorsodistal margin, carpus unarmed.

Right cheliped often not appreciably larger than left. Chela of right subrectangular to subtriangular; dorsal surface of palm circumscribed by row of dorsomesial, dorsoproximal and dorsolateral marginal spines; angle of propodal-carpal articulation approximately 15° from horizontal plane. Left chela with dactyl elongate and considerably narrower than fixed finger; dorsolateral margin of chela elevated, at least proximally, and frequently expanded; angle of propodal-carpal articulation variable. Sternite

of 3rd pereopods with semisubcircular, subovate or slender rod-like anterior lobe. Fourth pereopods with propodal rasp consisting of single row of corneous scales; dactyl with very to moderately short claw and minute preungual process at base.

Abdomen frequently straight or only weakly flexed. Uropods symmetrical or asymmetrical. Telson with transverse suture; posterior lobes symmetrical or subequal, terminal margins straight, oblique or rounded, armed with 1–4 strong, often blunt spines and few smaller spines or spinules, lateral margins each with undifferentiated, usually weakly calcified plate. Males without paired pleopods, with 3 unequally biramous pleopods. Females with paired 1st pleopods modified as gonopods, with 4 unpaired biramous pleopods, 2nd–4th with both rami well developed, 5th with endopod reduced.

Distribution. Japan, Bonin Islands, East China Sea; New Zealand; 12–300 metres.

Etymology. From the Latin *australis*, meaning southern and *eremus* a hermit.

Remarks. Melin (1939) subdivided *Eupagurus* Brandt into a number of subgenera, among them the nominal subgenus *Eupagurus*. In this taxon, Melin mentioned only *Eupagurus* (*Eupagurus*) *triserratus* Ortmann. Although Melin had both male and female specimens of this species at his disposal, he apparently overlooked the presence of paired first pleopods in the females.

Forest and de Saint Laurent (1968) provided a diagnosis of *Pylopagurus* based on Milne Edwards and Bouvier's (1893) description of the genus. However, in their original generic diagnosis Milne Edwards and Bouvier (1891) included only two species, *Pylopagurus discoidalis* (A. Milne Edwards) and *P. unguulatus* (Studer). Neither of these species was mentioned by Forest and de Saint Laurent (1968) in their discussion. Miyake (1978) designated *P. discoidalis* as the type of the genus; however, the only other species cited was the Japanese *P. serpulophilus*, a species we believe to be the junior subjective synonym of *A. triserratus*.

In the initial diagnoses of pylopagurid-like genera (McLaughlin, 1981a), the key character employed to distinguish *Pylopagurus* sensu stricto from other genera, including *Australeremus*, was uropod symmetry. Specimens of *A. cookii* available at the time all had coiled abdomens, suggestive of gastropod shell usage. In all cases the uropods were markedly asymmetrical. In contrast, available specimens of *P. stewarti*

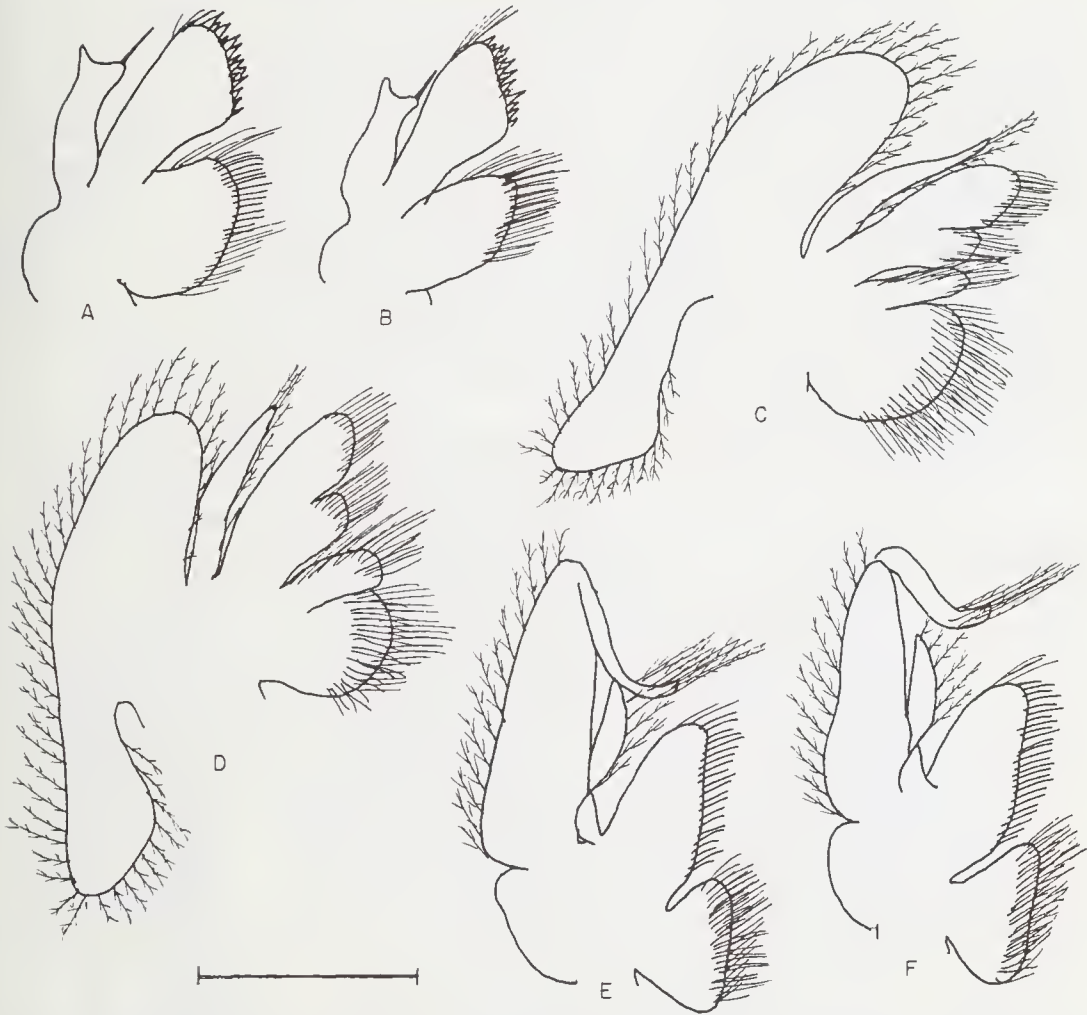


Figure 8. *Australeremus*. A, C, E, *A. laurentae* sp. nov., A, maxillule; C, maxilla; E, first maxilliped. B, D, F, *A. stewarti* (Filhol), B, maxillule; D, maxilla, F, first maxilliped. Scale = 1.0 mm (A, C, E) and 0.5 mm (B, D, F).

had elongate, straight abdomens that suggested scaphopod shell or worm tube usage. The uropods of these specimens were uniformly symmetrical. We have now had the opportunity to examine representatives of *A. cookii* removed from serpulid worm tubes. The uropods of these specimens vary from slightly asymmetrical to entirely symmetrical. Quite obviously, uropod symmetry, at least in *A. cookii*, is strongly influenced by habitat selection. *Pylopagurus* s.s. is more reliably distinguished from *Australeremus* by the shape and/or armature of the chelae: the dorsolateral margin of the left chela level or depressed and unarmed or minutely spinulose in

Pylopagurus but elevated, often inflated, and strongly spinose in *Australeremus*. The dorsomesial, dorsoproximal and dorsolateral margins of the right chela, although distinctly circumscribing the palm in both genera, are unarmed in *Pylopagurus* but spinose in *Australeremus*.

With the present emendation of the generic diagnosis of *Australeremus*, it becomes clear that *Pylopagurus stewarti* shares more generic characters with species of *Australeremus* than with *Pylopagurus* s.s. and is transferred herein to the former genus. McLaughlin's retention of *P. serpulophilus* in *Pylopagurus* was based entirely on Miyake's (1978) description and illustration.

We have now had the opportunity to examine specimens of Ortmann's (1892) *Eupagurus triserratus*, a species we believe to be the senior subjective synonym of Miyake's (1978) taxon, and find that it too should be assigned to *Australeremus*.

As among species of *Lophopagurus*, intrageneric similarities and intraspecific variations are common in species of *Australeremus*. Similarities include the usually marked rotation of the propodal-carpal articulation of the left chela, and in *A. cookii*, *A. kirkii*, and *A. cristatus* a prominent patch of red on the dorsal surfaces of the chelae at the point of articulation of dactyl

and fixed finger. Intraspecific variations involve, among others, the strength of the armature of the chelae, observed particularly in *A. stewarti* and *A. eltaninae*; the armature of the dactyls and propodi of the ambulatory legs, which varies from unarmed to strongly spinose dorsal margins in *A. cookii*; and size-related carpal length-width ratios of *A. stewarti*. *Australeremus cookii*, *A. laurentae* n. sp., and *A. stewarti* commonly inhabit bryozan tubes (Taylor et al., 1989, PMcL pers. obs), whereas *A. triserratus* is often found in serpulid worm tubes. Habitat has been found to strongly affect uropod symmetry, at least in the case of *A. cookii*.

Key to species of *Australeremus*

1. Dorsal surfaces of chelae covered with closely-spaced, flattened tubercles 2
- Dorsal surfaces of chelae with spines or well developed tubercles . . . 3
2. Ventrolateral margin of carpus of right cheliped armed with row of spines or spinules; ventral margins of meri of 2nd pereopods each with several spines *A. cookii*
- Ventrolateral margin of carpus of right cheliped unarmed; ventral margins of meri of 2nd pereopods unarmed *A. laurentae*
3. Dorsal margins of propodi of 3rd pereopods each with row of spines *A. cristatus*
- Dorsal margins of propodi of 3rd pereopods without row of spines . . . 4
4. Dorsal margins of carpi of 2nd pereopods each with row of spines (dactyls with 13–17 corneous spines on ventral margins) *A. kirkii*
- Dorsal margins of carpi of 2nd pereopods only with spine at dorsodistal angle and occasionally 1 spine in proximal half 5
5. Dorsal margins of dactyls of ambulatory legs unarmed *A. triserratus*
- Dorsal margins of dactyls of 2nd pereopods with spines or protuberances 6
6. Right cheliped (dorsal view) with chela rectangular, carpus width $< \frac{1}{2}$ length; ventrolateral margin of merus of left cheliped unarmed or with 1 small spine at distal angle *A. stewarti*
- Right cheliped (dorsal view) with chela subtriangular, carpus width $> \frac{2}{3}$ length; ventrolateral margin of merus of left cheliped with row of acute spines in distal half *A. eltaninae*

Australeremus cookii (Filhol)

Figures 9

Eupagurus Cookii Filhol, 1883: 67. — 1885b: 417, pl. 51 fig. 2.

Eupagurus cookii. — Thomson, 1898: 176 (? in part), ? pl. 20 figs 11–13 (see remarks). — Alcock, 1905: 176 (list). — Chilton, 1911: 299. — Thompson, 1930: 270 (? in part, see remarks).

?*Eupagurus stewarti*. — Chilton, 1911: 298 (in part, see remarks under *A. stewarti*).

Pagurus cookii. — Gordan, 1956: 328 (list).

Pylopagurus cooki. — Forest and de Saint Laurent, 1967: 145. — McLaughlin, 1981a: 4.

?“a hermit crab”. — Morton and Miller, 1968: 577, fig. 215 (2) (see remarks under *A. stewarti*).

?*Pylopagurus cooki*. — Batham, 1969: 79. — Probert et al., 1979: 381, 388 (list) (see remarks).

?*Pagurus cooki*. — Rainer, 1981: 37 (see remarks).

Australeremus cooki. — McLaughlin, 1981a: 4 (by implication). — Schembri and McLay, 1983: 31 (in part), figs 10a, b, 11 (see remarks).

?*Australeremus cooki*. — Schembri, 1982: 865, figs 6, 7. — 1988: 93 (list). — Probert and Wilson, 1984: 389 (list). — Taylor et al., 1989: 1064 (see remarks).

Holotype. Not seen.

Material examined. USNS *Eltanin* stn 23/1716 (37°35'S, 178°46'E), 128–146 m, 28 May 1966. USNM 244442 (1 female, 3.8 mm). RV *Tangaroa*, NZOI stn R

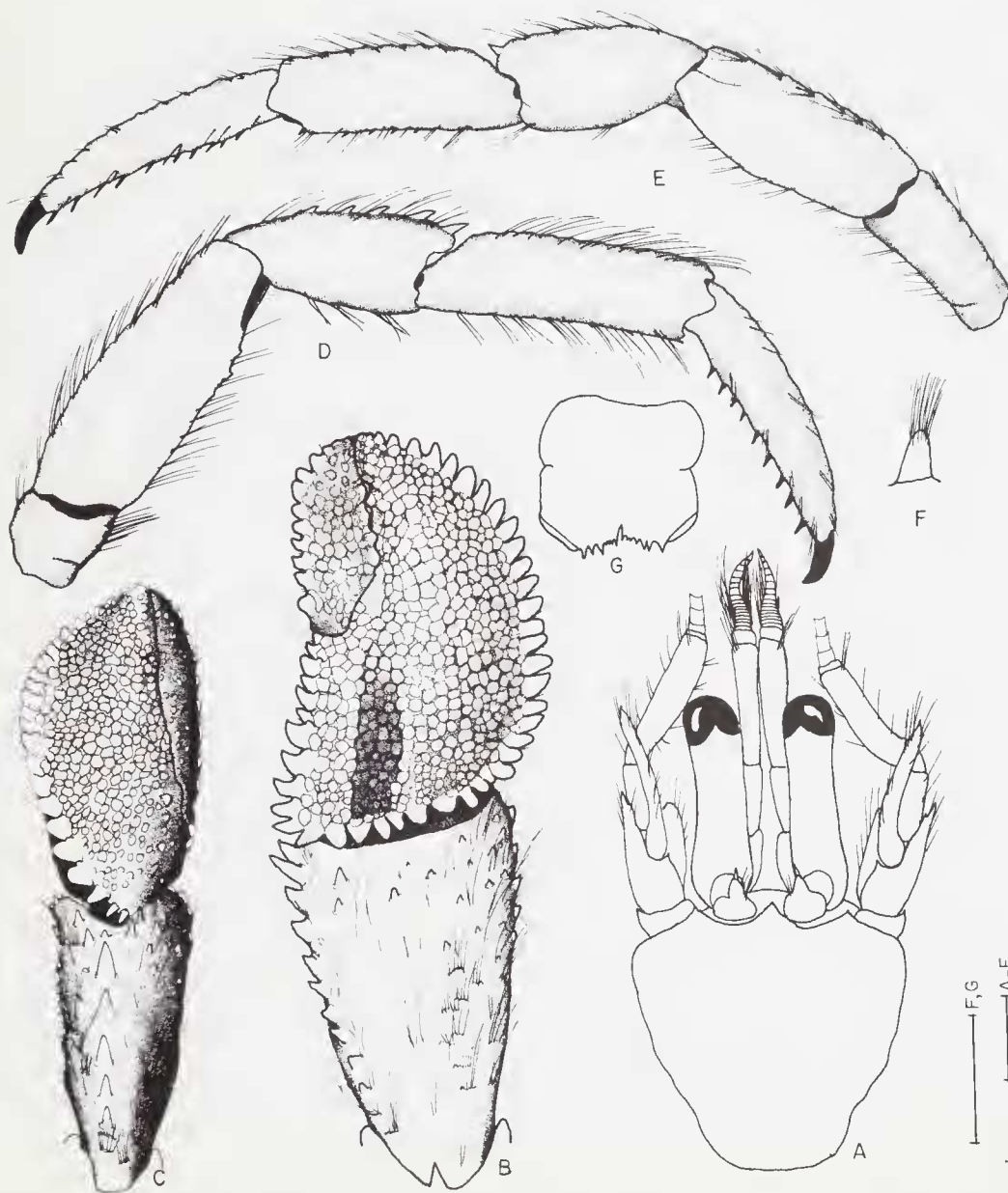


Figure 9. *Australeremus cookii* (Filhol), male from *Eltanin* stn 16/1431, USNM 244441. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view); C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, left 3rd pereopod (lateral view); F, anterior lobe of sternite of 3rd pereopods; G, telson. Scales = 2 mm (A-E) and 1 mm (F, G).

81, approximately 28 km N of Motuhora I. (37°35.9'S, 176°59.5'E), 139-179 m, 20 Jan 1979, NMNZ Cr7403 (2 males, 1.7, 3.4 mm). RV *Acheron* stn BS 505 (40°47'S, 174°10.5'E), 73 m, 4 Mar 1976, NMNZ Cr8348 (4 males, 2 females, 2.2-5.0 mm). RV *Tangaroa*, NZOI stn R 30 (41°31.4'S, 174°52.6'E), 255-553 m, 15 Jun 1979, NMNZ Cr7403 (1 male, 2.8 mm). USNS *Eltanin* stn 23/1709 (43°31'S, 176°10'W), 143-

186 m, May 24, 1966, USNM 244440 (1 male, 3.1 mm). USNS *Eltanin* stn 16/1431 (45°37'S, 170°58'E), 51 m, 23 Feb 1965, USNM 244441 (3 males, 2 females, 2.8-3.7 mm). Mid-shelf off Otago Peninsula, P.J. Schembri, PML (13 males, 9 females, 1.9-5.0 mm). Dunedin, G.M. Thomson, AM G2127 (2 males, 2 females, 3.9-4.7 mm).

Redescription. Shield as long or longer than broad; anterior margin between rostrum and lateral projections concave; posterior margin truncate. Rostrum broadly triangular, terminating acutely. Lateral projections obtusely triangular, with small terminal spinule. Posterior carapace with tufts of setae adjacent to cervical groove.

Ocular peduncles $\frac{3}{4}$ – $\frac{4}{5}$ length of shield, corneae slightly dilated. Ocular acicles narrowly triangular, terminating subacutely and with strong submarginal spine; separated basally by $\frac{3}{4}$ –slightly more than basal width of 1 acicle.

Antennular peduncles when extended overreaching ocular peduncles by $\frac{1}{2}$ – $\frac{3}{4}$ length of ultimate segment. Ultimate segment with 3 or 4 long setae at dorsolateral distal margin.

Antennal peduncles overreaching corneae by $\frac{1}{4}$ – $\frac{1}{2}$ length of ultimate segment. Fifth and fourth segments with scattered setae dorsally and ventrally. Third segment with ventrodistal angle unarmed or with small spinule on ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in acute spine, mesial margin with 2–5 accessory spines; dorsomesial distal angle with acute spine. First segment with small spine or spinule on lateral distal margin. Antennal acicle somewhat arcuate, reaching proximal third to half of ultimate peduncular segment. Flagella with 2–4 long (>4 articles length) and 1 or 2 short setae every, or every second article, at least in proximal $\frac{2}{3}$.

Right cheliped with dactyl slightly longer than palm; terminating in corneous claw and overlapped by fixed finger. Dorsal surface of dactyl covered almost completely with flattened tubercles, dorsomesial margin with row of compressed, blunt spines and few tufts of setae. Palm $\frac{1}{2}$ – $\frac{2}{3}$ length of carpus; dorsomesial, dorsoproximal and dorsolateral margins, each with row of compressed, blunt or acute spines, jointed to completely circumscribe palm and fixed finger. Dorsal surface of palm and fixed finger covered with flattened tubercles, midline slightly elevated to form low broad ridge, extending complete length of fixed finger, dorsomesial face of palm marked by deep, rectangular depressed area, dorsolateral surface sloping to dorsolateral margin. Carpus with row of acute spines on dorsomesial margin, dorsolateral margin not distinctly delimited, dorsal surface flattened and with few scattered spinules and spinulose ridges, some extending onto lateral face dorsally; ventrolateral margin with row of small, blunt spines or spinules; mesial face concave, particularly in

larger specimens. Merus approximately $\frac{2}{3}$ length of carpus; dorsodistal margin with 1 acute spine, dorsal surface with transverse rows of tufts of setae; ventromesial and ventrolateral margins each with row of spines. Ischium with row of spinules on ventromesial margin.

Left cheliped somewhat shorter than right, but nearly as massive; propodal-carpal angle of articulation 80° – 90° from horizontal plane. Dactyl 3–4 times length of palm; terminating in corneous claw and overlapped by fixed finger. Dorsal surface of dactyl often with double row of small granules or protuberances near cutting edge, dorsomesial margin with row of small spinules or tubercles and few setae. Palm with dorsolateral margin expanded, strongly elevated proximally but becoming ventral in position distally on fixed finger, armed with row of strong, compressed, somewhat blunted spines, dorsolateral surface covered with low, flattened tubercles, dorsomesial surface unarmed or with scattered small tubercles, dorsomesial margin with few low spinulose protuberances or blunt spines. Carpus subtriangular in cross-section: dorsal surface with row of acute spines laterally and tufts of moderately long setae; ventrolateral margin sometimes with 2 or 3 blunt spines or tubercles distally; mesiodistal margin frequently with few to several spines. Merus with transverse ridges and tufts of setae on dorsal margin; ventrolateral margin with row of acute spines, strongest distally, ventromesial margin with row of spines, strongest proximally. Ischium with row of spinules on ventromesial margin.

Ambulatory legs generally similar from right to left. Dactyls slightly shorter (2nd) to slightly longer (3rd) than propodi; dorsal margins each with row of low protuberances, sometimes developed into distinct spines in large individuals (SL > 4.5 mm), and tufts of moderate to long setae, lateral faces often with faint longitudinal sulcus, mesial faces of 2nd unarmed or with dorsal row of corneous spinules, 3rd with dorsal and ventral rows of widely-spaced corneous spinules, ventral margins each with row of 9–15 corneous spines. Propodi each with row of protuberances or spines and tufts of setae on dorsal surface, ventral margins each with row of small corneous spinules. Carpi of 2nd with row of spines on dorsal margin, occasionally reduced or lacking on left; 3rd with dorsodistal spine, less frequently 1 or 2 additional spines in proximal half, occasionally complete row of spines. Meri with setae on dorsal margins, ventral margins each with 2 or 3 small spines in distal half (2nd) or unarmed (3rd) and with tufts of long setae.

Ischia unarmed, but with setae dorsally and ventrally.

Sternite of 3rd pereopods with subovate or subquadrate anterior lobe provided with tuft of setae on anterior margin. Telson with terminal margins armed with few small and few larger spines toward external angles; posterolateral margins each composed of simple, calcified plate.

Colour. "Eystalks and antennules white with some brownish markings; antennae red with narrow white bands; 2nd and 3rd maxillipeds vivid deep blue; chelipeds pale to dark brown with a red spot on the propodites; walking legs pale to dark brown." (Schembri and McLay, 1983; voucher photograph).

Distribution. Eastern New Zealand from Motuhora Island to Dunedin: 51–553 m.

Affinities. *Australeremus cookii* bears close superficial similarities to *A. kirkii* and *A. cristatus*, particularly in the colour pattern of the chelae; however it may be distinguished from both of the latter species by the armature of the dorsal surfaces of the chelae. In *A. cookii* these surfaces are armed with flattened tubercles; in *A. kirkii* and *A. cristatus* these surfaces are armed with spines or spinulose tubercles. A second, and undescribed species is also characterized by flattened tubercles on the dorsal surfaces of the chelae. *Australeremus laurentae* is distinguished from *A. cookii* by the reduced armature on the ambulatory legs and the proportions of the dactyls and propodi of these appendages (also see Affinities under *A. laurentae*).

Remarks. Filhol's (1885b) illustration of *A. cookii* (pl. 51 fig. 2) is inaccurate in several significant points.

1. The depression on the right chela is positioned more dorsolaterally than it actually is.

2. The left chela has a triangular appearance with an elevated crest in the midline; the propodal-carpal articulation is generally in horizontal plane. There is actually only a slight elevation to the midline of the chela and the propodal-carpal articulation is approximately 90° in all specimens we have examined.

3. Filhol's specimen (presumably a male) is shown with paired pleopods on the 3rd to 5th abdominal somites. Only unpaired pleopods are present on the left side, as in most adult pagurids.

Thomson (1898) redescribed *E. cookii* from specimens collected at Dunedin and Stewart

Island in south-eastern New Zealand. Although in his text he refers to the chelipeds being covered with rounded granulations, his figures are more suggestive of spines (pl. 20 figs 11–13). We have examined Thomson's specimens from Dunedin (AM G2127) and confirmed their identity as *A. cookii*; however, none agrees with his figures. It is, therefore, possible that his specimens from Stewart Island represent another taxon, perhaps *A. cristatus*. We have not been able to confirm the identity of the mutilated specimen from Bounty Bay that he also referred to *A. cookii*.

Thompson (1930) stated that his specimens of *Eupagurus cookii* fell into two distinct groups, those agreeing with Thomson's (1898) description and those that agreed far better with Filhol's (1883, 1885b) description and figure. Thompson's (1930) "differential diagnoses" clearly substantiate his conclusions. Considering the brevity of Filhol's (1883; 1885b) descriptions and the inaccuracies of his figure, it is not surprising that Thompson proposed the group presumably representing Thomson's (1898) species would prove to be distinct. We have not been able to reexamine Thompson's (1930) collection; however, his descriptions suggest that the group he attributed to Thomson's (1898) taxon was in fact *A. cookii*. Given the variability observed in the armature of the ambulatory legs in this species, Thompson's second group, agreeing with Filhol's figure, may also be *A. cookii* or may represent H. Milne Edwards' (1836) *Pagurus cristatus* (= *A. cristatus*), a species occasionally confounded with *A. cookii*.

Batham (1969), Probert et al. (1979), Rainer (1981), Schembri (1982, 1988), Schembri and McLay (1983), Probert and Wilson (1984), and Taylor et al. (1989) presumably all reported on the same species. We have examined a voucher series of Schembri and McLay's (1983) "*A. cookii*" deposited at the Portobello Marine Laboratory and found both *A. cookii* and *A. kirkii* represented; Schembri's (1982) figures of the antennal flagellum agree equally well with both species. Four lots of specimens from the National Museum of New Zealand (Cr4703, 4910) identified as *A. cookii* have proved to be *A. cristatus*. None of the aforementioned authors included either *A. kirkii* or *A. cristatus* in their faunal lists. As all three species apparently show the red spot of colour on the palms of the chelipeds reportedly characteristic of *A. cookii*, until each author's material is examined thoroughly, it will not be possible to confirm their reports of *A. cookii*.

***Australeremus laurentae* sp. nov.**

Figures 8A, C, E; 10A–H

Pylopagurus "mauve antenna 1". — Probert et al., 1979: 386.*Pylopagurus* sp. nov. — Schembri, 1982: 869, fig. 8.*Pylopagurus* n. sp. — Schembri and McLay, 1983: 31, fig. 13. — Probert and Wilson, 1984: 389. — Schembri, 1988: 93. — Taylor et al., 1989: 1062.*Type material.* Holotype, New Zealand, RV *Acheron* stn BS 490 approximately 10 miles SW of Waitotara River (39°57'S, 174°34'E), 33–35 m, 2 Mar 1976, NMNZ Cr8241 (male, 3.0 mm).

Paratypes, Whangarei Harbour, North Island, New Zealand, 27 Sep 1972 NMV J21016 (1 male, 3.3 mm), NE side main island, Open Bay Islands, G.D. Fenwick, 7–11 m, 5 Feb 1976, NMNZ Cr4197 (1 female, 3.1 mm). RV *Acheron* stn BS 408 off Kopumiti Pt, Whangaroa Harbour, 10–15 m, 22 Feb 1974, NMNZ Cr7399 (1 male, 3.3 mm). Bare Island, Hawkes Bay (39°49'S, 177°02'E), C. Duffy, 15 m, 13 Dec 1990, USNM 244456, NHRM type colln 4282, RMNH D 40431 (7 males, 1 female with rhizocephalan, 3.1–3.9 mm). RV *Acheron* stn BS 490 approximately 10 mi. SW of Waitotara River Mouth (39°57'S, 174°34'E), 33–35 m, 2 Mar 1976, NMNZ Cr7401 (5 males, 2 females, 3.0 mm). RV *Acheron* stn BS 488 approximately 18 miles S of Waitotara River Mouth (40°09.5'S, 174°36'E), 82 m, 2 Mar 1976, NMNZ Cr7400 (1 male, 1 female, 3.4, 3.6 mm). RV *Acheron* stn BS 500, off Port Gore, Marlborough Sounds (40°57.5'S, 174°18'E), 139–144 m, 3 Mar 1976, NMNZ Cr4913 (4 males, 5 females, 2 with rhizocephalans, 1.6–3.8 mm). Tawero Point, Pelorus Sound, K.W. Briden, 11.5–15 m, 6 Dec, 1989, NMNZ Cr34 (1 female with rhizocephalan, 3.6 mm). Off South Trio Island, Admiralty Bay, 5 Apr, 1990, NMNZ Cr52 (1 female, 2.1 mm). Clay Point, P. Fullerton, K. Bayden, 21 m, 8 Apr, 1990, NMNZ Cr51 (1 male 4 females, 1 "intersex", 1.4–3.4 mm). Off Mana I., Wellington, V. Hoggard, 21 m, 27 Apr 1969, NMNZ Cr7398 (2 males, 1 female, 1.8–2.2 mm). USNS *Eltanin* stn 25/370 (43°22'S, 175°20'E), 95 m, 19 Nov 1966, USNM 244455 (1 ovigerous female, 4.0 mm). Hanson Bay, Chatham Islands (44°00'S, 176°18'E), 27 m, 27 Jan 1954, NMNZ Cr4199 (1 ovigerous female, 1.6 mm). USNS *Eltanin* stn 16/1431 (45°37'S, 170°58'E), 51 m, 23 Feb 1965, USNM 244462 (1 male, 3 females, 1.9–3.0 mm).

Description. Shield as long or longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margin sloping; posterior margin truncate. Rostrum triangular, terminating in small spinule. Lateral projections broadly rounded, with submarginal spine. Posterior carapace with tufts of setae adjacent to cervical groove.

Ocular peduncles $\frac{3}{4}$ – $\frac{4}{5}$ length of shield, cornea slightly dilated. Ocular acicles triangular,

terminating subacutely and with strong submarginal spine; separated basally by $\frac{3}{4}$ –slightly more than basal width of 1 acicle.

Antennular peduncles when extended overreaching ocular peduncles by $\frac{1}{2}$ – $\frac{3}{4}$ length of ultimate segment. Ultimate segment with 2 or 3 long setae at dorsolateral distal margin. Penultimate segment with few scattered setae. Basal segment with spine on lateral face distally.

Antennal peduncles overreaching cornea by $\frac{1}{2}$ – $\frac{3}{4}$ length of ultimate segment. Fifth and fourth segments with scattered setae dorsally and ventrally. Third segment with ventrodial angle usually unarmed, occasionally with small spinule on ventrodial margin. Second segment with dorsolateral distal angle produced, terminating in acute spine, mesial margin with 2 or 3 accessory spines; dorsomesial distal angle with small spine. First segment occasionally with small spine or spinule on lateral distal margin, ventral margin produced, unarmed or with small spine laterally. Antennal acicle reaching to base of ocular peduncles, terminating in acute spine, ornamented with numerous tufts of setae. Flagella with 3 or 4 very long (> 5 articles length) every 1 or 2 articles proximally, every 2–4 articles distally.

Chela of right cheliped subrectangular in dorsal view; dactyl $\frac{1}{2}$ – $\frac{2}{3}$ length of palm; cutting edge with row of calcareous teeth in proximal $\frac{1}{5}$, corneous teeth distally, terminating in corneous claw and overlapped by fixed finger. Dorsal surface of dactyl with small, usually flattened tubercles, often covering entire surface, dorsomesial margin with row of closely-spaced spines and few tufts of setae; mesial face and ventral surface with few tufts of setae. Palm $\frac{2}{3}$ – $\frac{3}{4}$ length of carpus; dorsomesial, dorsoproximal and dorsolateral margins each with row of closely-spaced, blunt or acute spines joined to completely circumscribe palm and fixed finger. Dorsal surface of palm and fixed finger generally level, covered with flattened tubercles, occasionally those of midline developed into low, tear drop-shaped spines; mesial, lateral and ventral surfaces unarmed, but with few scattered setae; cutting edge of fixed finger with row of calcareous teeth, terminating in corneous claw. Carpus slightly longer than merus; dorsomesial margin with row of acute spines, dorsal surface flattened, with 1 or 2 spines near distal margin and row of spines laterad of midline, dorsolateral margin not distinctly delimited but with transverse ridges and tufts of setae extending onto lateral face dorsally; ventrolateral margin unarmed; mesial face weakly concave, unarmed but with scattered short setae; ventral surface

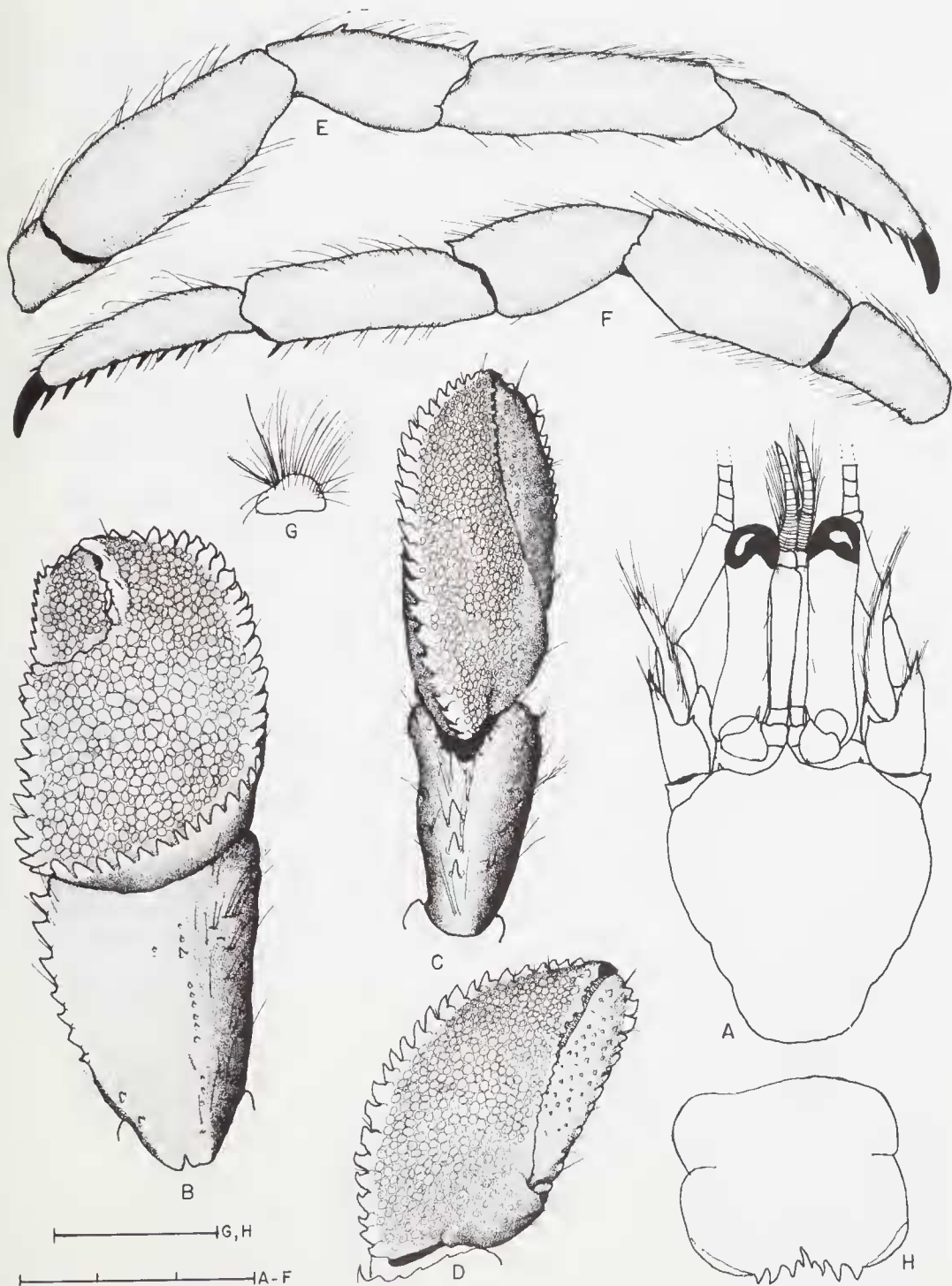


Figure 10. *Australeremus laurentae* sp. nov., male paratype, from Bare Island, Hawkes Bay, New Zealand, USNM 244456. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view); C, chela and carpus of left cheliped (dorsal view); D, chela of left cheliped (dorsomesial view); E, right 2nd pereopod (lateral view); F, left 3rd pereopod (lateral view); G, anterior lobe of sternite of 3rd pereopods; H, telson. Scales = 3 mm (A-F) and 1 mm (G, H).

with scattered, short setae. Merus with 1 acute spine at dorsodistal margin, dorsal surface with transverse rows of tufts of setae; ventromesial margin with 2 or 3 spines or spinulose tubercles in proximal half, ventrolateral margin with short row of acute spines in distal half. Ischium with row of tubercles or spinules on ventromesial margin.

Left cheliped somewhat shorter than right; propodal-carpal angle of articulation 80° – 90° from horizontal plane. Dactyl $2\frac{1}{2}$ –3 times length of palm; cutting edge with row of corneous teeth, terminating in corneous claw and overlapped by fixed finger; dorsal surface usually with 2 or 3 irregular rows of small granules or spinules, dorsomesial margin with row of small spines and few setae; ventral surface with scattered setae. Palm with dorsolateral margin strongly elevated proximally and armed with row of strong, compressed spines, decreasing in size only slightly on fixed finger, dorsal surface covered with usually low, flattened tubercles laterally but with only scattered small tubercles mesially, dorsomesial margin with 2 or 3 spinulose protuberances; cutting edge of fixed finger with row of small calcareous teeth interspersed with corneous teeth, terminating in corneous claw. Carpus triangular in cross-section; dorsal midline with row of very strong, acute spines and tufts of moderately long setae; mesial and lateral distal margins often spinulose, surfaces with scattered tufts of setae; ventrolateral margin usually unarmed, ventromesial margin with few spinulose tubercles. Merus with transverse ridges and tufts of setae on dorsal margin; ventrolateral margin with row of acute spines distally, ventromesial margin with few spines or spinulose tubercles proximally. Ischium with row of tubercles or spinules on ventromesial margin.

Ambulatory legs generally similar from right to left. Dactyls shorter than propodi; broad proximally, tapering distally; terminating in strong, corneous claws; dorsal margins each with somewhat spinulose protuberances or small spines (2nd) or low protuberances (3rd) and tufts of setae, lateral and mesial faces each with faint longitudinal sulcus, ventral margins each with row of 8–12 corneous spines. Propodi each with row of low protuberances and tufts of setae on dorsal surface, ventral margins each usually with row of widely-spaced corneous spinules. Carpi each with spine at dorsodistal margin, 2nd (at least right) also with 1 spine in proximal half of dorsal margin. Meri unarmed, but with setae on dorsal and ventral margins. Ischia with setae dorsally and ventrally.

Sternite of 3rd pereopods with subsemicircular anterior lobe provided with tuft of setae on anterior margin; sternites of 4th and 5th pereopods frequently with row of thick setae. Uropods most frequently symmetrical. Telson with terminal margins armed with few small to moderately large spines near median cleft; posterolateral margins each composed of simple, calcified plate.

Colour. (Few weeks in preservative): Chelae with dorsal surfaces uniformly orange. Dactyls of ambulatory legs white proximally, medially and distally separated by bands of colour, and with 1 coloured longitudinal stripe on lateral and mesial face; propodi and meri each with median band of colour, propodi also with coloured median longitudinal stripe on mesial and lateral face; carpi with 2 or 3 longitudinal stripes of colour on lateral faces.

Etymology. This species is named for Michèle de Saint Laurent who first recognized its distinction from *A. cookii*.

Distribution. Western and eastern North Island to eastern South Island, New Zealand and Chatham Islands; 10–144 m.

Affinities. *Australeremus laurentae* is most closely allied to *A. cookii*. These species share the distinctive flattened tuberculate armature of the chelae that sets them apart from other species of the genus. Similarly, the dactyls of the ambulatory legs of both species may have spinose dorsal margins. *Australeremus laurentae* is most easily distinguished from *A. cookii* in the following characters. The palm of the right chela lacks the deep rectangular depression on the dorsomesial surface that is usually present in all but the smallest specimens of *A. cookii*. The dactyls of the 2nd and 3rd pereopods of *A. laurentae* are shorter than the propodi; the carpi of the 2nd pereopods (only) have 1 dorsodistal and 1 dorsoproximal spine; the ventral margins of the meri of both 2nd and 3rd pereopods are unarmed. The ventrolateral margin of the carpus of the right cheliped in this species is also unarmed, whereas this margin in *A. cookii* is crenulate, tuberculate or spinulose. It also appears that *A. laurentae* lacks the dark red spot of colour at the articulation of the dactyls and fixed fingers of the chelae that is present in *A. cookii*, *A. cristatus*, and *A. kirkii*.

Remarks. Whereas variation in the armature of the pereopods appears highly variable in *A. cookii*, the flattened tubercles characteristic of the

dorsal surfaces of the palms of the chelae appears constant. However, in *A. laurentae*, the pereopodal armature appears to remain constant, but the tubercles in the midline of the dorsal surface of the palm of the right chela occasionally may be slightly produced to form very low, blunt tear-drop shaped spines.

The specimens of *A. laurentae* collected just north of Bare Island, Hawkes Bay were found on a small reef under a canopy of the brown kelp *Ecklonia radiata* (C. Agardh) J. Agardh. There was a sparse understorey of small algae (greens, browns and reds), the bryozoan *Orthoscuticella* sp. and the massive sponge *Ancorina alata*. The rock surface was heavily encrusted with coral-line algae, which was thinly covered with a fine silt. The hermits were very common, occurring individually or in small clusters of up to 4 or 5 animals, either with their encrusted shells exposed on the surface of the rock or tucked away in small fissures and crevices [C. Duffy (collector), pers. comm.].

Australeremus cristatus (H. Milne Edwards)

Figure 11

Pagurus cristatus H. Milne Edwards, 1836: 269. — 1837: 218. — 1848: 60. — Dana, 1853: 441. — Gordon, 1956: 329.

Eupagurus cristatus. — Miers, 1876: 62 (? in part; see remarks). — Hutton, 1882: 264. — Filhol, 1885b: 412. — Thomson, 1898: 184. — Alcock, 1905: 176.

?*Eupagurus cookii*. — Thompson, 1930: 270 (in part), see remarks.

Pylopagurus cristatus. — Forest and de Saint Laurent, 1967: 145. — McLaughlin, 1981a: 3.

?*Lophopagurus cristatus*. — McLaughlin, 1981a: 3 (by implication).

Not *Pagurus cristatus*. — White, 1847: 59 (see remarks).

Holotype. Not seen.

Material examined. RV *Tangaroa*, NZOI stn R 83 (37°45.8'S, 177°00.8'E) 72–84 m, 20 Jan 1979, NMNZ Cr8349 (1 male, 4.6 mm). RV *Tangaroa*, NZOI stn R 86 (37°51.8'S, 176°56.8'E) 34–39 m, 21 Jan 1979, NMNZ Cr8350, (1 female, 4.4 mm). Approximately 3 mi. offshore from Kaikoura, 30–60 m, 24 Jan 1967, NMNZ Cr3965 (8 males, 2 intersex, 9 females, 5.7–8.2 mm). Off Kaikoura 1 mi., 1. Mannering, 75 m, 10 Mar 1965, NMNZ Cr4116 (1 male, 9 females, 2 ovigerous females, 3.3–6.9 mm) RV *Acheron* stn BS 557, 5 mi. E of Steep Head, Banks Peninsula (43°45'S, 173°14'E) 66 m, 27 Sep 1976, NMNZ Cr8351 (1 ovigerous female, 6.0 mm). RV *Acheron* stn BS 556, E of Pompeys Pillar (43°52.5'S, 173°06'E), 44 m, 27 Sep 1976, NMNZ Cr4910 (1 male, 2 intersex – 1 with rhizocephalan parasite, 1 ovigerous female, 3.2–6.4 mm).

Redescription. Shield approximately as broad as long; anterior margin between rostrum and lateral projections concave; posterior margin truncate. Rostrum, triangular, acute, with minute terminal spinule. Lateral projections obtusely triangular, terminating in strong, marginal spine. Posterior carapace with tufts of setae adjacent to cervical groove.

Ocular peduncles short, $\frac{1}{2}$ – $\frac{2}{3}$ length of shield; dorsal surface with row of tufts of setae; cornea very slightly inflated. Ocular acicles narrowly triangular, terminating subacutely, and with strong submarginal spine; separated basally by slightly more than basal width of 1 acicle.

Antennular peduncles exceed ocular peduncles by almost entire length of ultimate segment. Ultimate segment with tuft of long setae on dorsolateral distal angle.

Antennal peduncles overreach ocular peduncles by $\frac{1}{2}$ – $\frac{2}{3}$ length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with small spine at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in strong spine, mesial margin with series (6–10) of small spines or spinules, lateral margin with few setae; dorsomesial distal angle with acute spine. First segment with small spine at laterodistal margin. Antennal acicle overreaching ocular peduncle by $\frac{1}{4}$ – $\frac{1}{3}$ own length, terminating in small spine, mesial margin with row of tufts of setae. Antennal flagellum not reaching to tip of right cheliped; articles randomly provided with 1 or 2 short to moderately long (1–3 article length) setae.

Right cheliped with dactyl slightly longer than palm; cutting edge with row of calcareous teeth in proximal $\frac{2}{3}$, corneous teeth distally; terminating in small corneous claw; dorsomesial margin with row of closely-spaced small spines, dorsal midline only slightly elevated, dorsal surface covered with small, sometimes spinulose, tubercles, few tufts of setae near cutting edge; ventral surface with scattered tubercles. Palm approximately $\frac{2}{3}$ length of carpus; dorsomesial margin with row of strong, acute spines, dorsal surface covered with closely-spaced spines or spinulose tubercles, midline with broad low longitudinal ridge separated from similar mesial ridge by longitudinal depression, 1 or 2 strong spines near dorsomesial margin proximally; dorsal surface of fixed finger similarly armed with closely-spaced small spinulose tubercles, dorsolateral margin with row of very closely-spaced small, acute or blunt spines becoming stronger near proximal margin; lateral face convex,

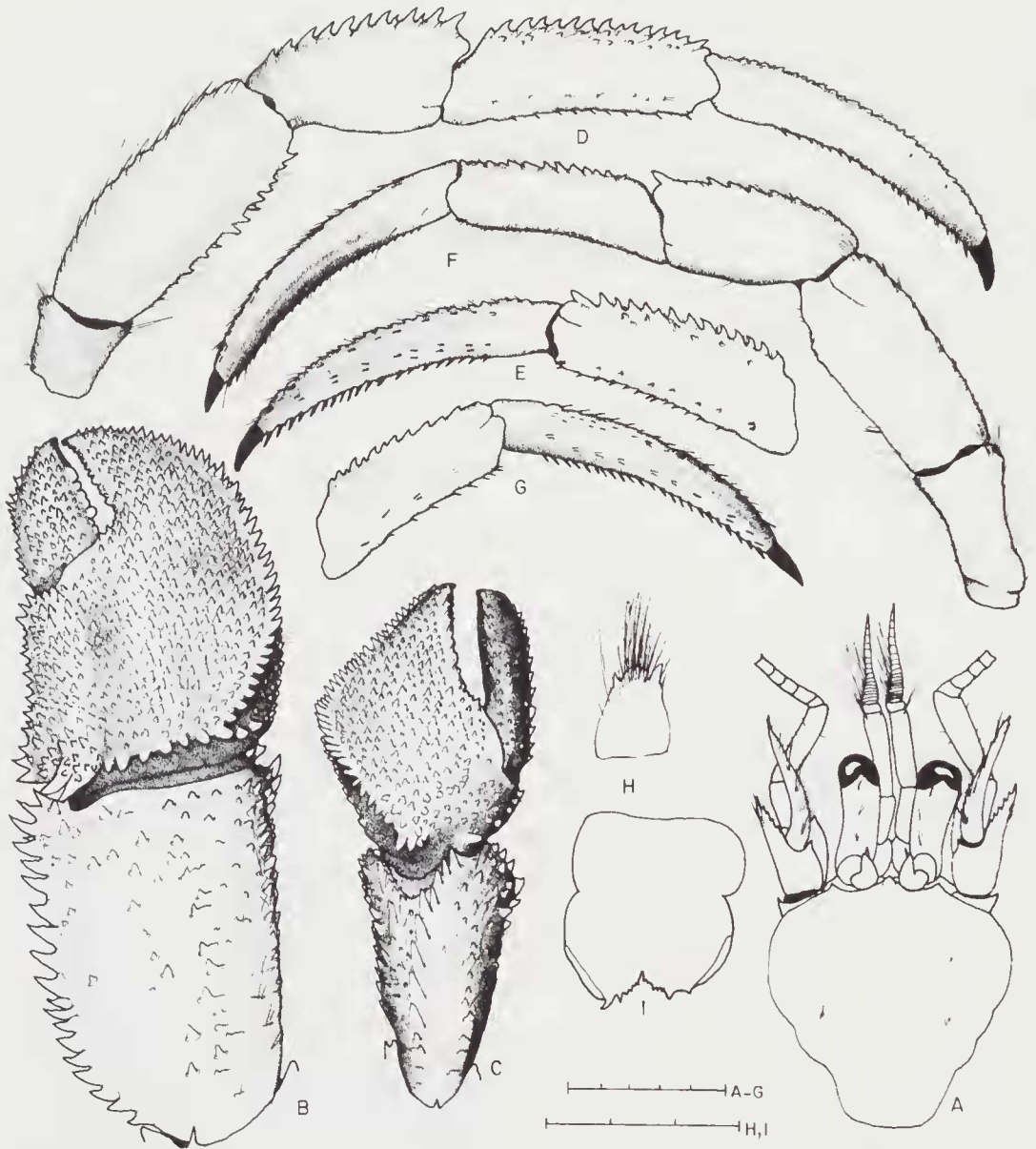


Figure 11. *Australeremus cristatus* (H. Milne Edwards), female from off Kaikoura, New Zealand, NMNZ Cr3965. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view); C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, propodus and dactyl of right 2nd pereopod (mesial view); F, left 3rd pereopod (lateral view); G, propodus and dactyl of left 3rd pereopod (mesial view); H, anterior lobe of sternite of 3rd pereopods; I, telson. Scales = 5 mm (A-G) and 3 mm (H, I).

armed with rows of small spinulose tubercles extending onto ventral surface. Carpus approximately equaling length of merus; dorsomesial margin expanded or flared laterally and armed with row of closely-spaced strong spines, dorsal

surface with few tubercles distally, row of small spines laterad of midline, dorsolateral margin with single or double row of small spines or spinulose tubercles, extending onto lateral face, ventrolateral margin with row of small spines;

mesial face somewhat concave and with few low spines or spinulose tubercles; ventral surface with few tubercles. Merus with 1 or 2 strong spines at dorsodistal margin, dorsal surface with transverse rows of tufts of long setae; mesial face with few scattered tubercles ventrally, ventromesial margin with row of spines; ventral surface with scattered tubercles, ventrolateral margin with row of acute spines. Ischium with row of spines on ventromesial margin.

Left cheliped not reaching to base of dactyl of right. Dactyl 3 to 4 times length of propodus; dorsal surface strongly sloping ventrally displacing dorsomesial row of spines to ventral marginal position; cutting edge with row of corneous teeth, terminating in corneous claw and slightly overlapped by fixed finger; often with prominent hiatus between dactyl and fixed finger. Palm $\frac{1}{4}$ – $\frac{1}{3}$ length of carpus; broadly expanded laterally; propodal-carpal angle of articulation approximately 80° from horizontal plane; dorsal surface of palm covered with closely-spaced small spines or spinulose tubercles, dorsolateral margin with row of closely-spaced, acute or blunt spines, 1 strong spine at point of propodal-carpal articulation, dorsomesial margin with few low protuberances or row of small spines; ventral surface with irregular rows of low spinules and scattered tufts of setae in lateral half. Carpus equaling or slightly shorter than merus; subtriangular in cross-section; dorsal midline with oblique row of strong spines and 1 or 2 irregular rows of smaller spines mesially and laterally, distal margin dorsally, laterally and mesially often with continuous row of spines; lateral and mesial faces with scattered spines or spinulose tubercles, ventrolateral and ventromesial margins each with row of spines; ventral surface spinulose. Merus with transverse rows of tufts of setae on dorsal margin, extending onto lateral and mesial faces dorsally; ventrolateral margin with double row of spines proximally, becoming single row distally, ventral surface with scattered small spines or tubercles, ventromesial margin with row of strong spines. Ischium with row of small spines on ventromesial margin.

Second and 3rd pereopods similar from left to right. Dactyls approximately half again length of propodi, terminating in strong corneous claws; in dorsal view, slightly twisted; in lateral view, curved ventrally; dorsal surfaces each armed with row of small calcareous spines accompanied by corneous spinules, at least on 2nd; lateral surfaces each with faint longitudinal sulcus flanked dorsally and ventrally by low pro-

tuberances and tufts of setae, ventral margins each with row of 20–24 corneous spines, mesial faces each with dorsal and ventral single or double rows of corneous spines. Propodi approximately equaling length of carpi; dorsal surfaces each with row of strong corneous spines and single or double row of corneous spinules, ventral surfaces each with row of low protuberances and corneous spinules strongest on 2nd. Carpi slightly shorter than meri; dorsal margins each with row of strong spines. Meri with transverse rows of tufts of setae on dorsal surfaces, ventral margins with 1 or 2 rows of spines (2nd) and tufts of setae (3rd). Ischia each with row of spines on ventral margin (2nd) or tufts of setae (3rd).

Sternite of 3rd pereopods with anterior lobe semisubovate, often with 1 or 2 spines near anterior margin and row of long setae. Fourth pereopod without preungual process at base of claw. Telson with posterior lobes slightly asymmetrical; terminal margins oblique, armed with 1–3 strong and several short spines, lateral margins each with undifferentiated plate.

Colour. Unknown; however, in some of the preserved specimens examined, a red-orange patch of colour has been present at the articulation of the dactyls and fixed fingers of both chelae.

Distribution. Eastern New Zealand; 30–84 m.

Affinities. In chela configuration, *A. cristatus* is closely allied to *A. cookii*, and may have been confounded with it by Thompson (1930). The armature of the chelipeds consists of flattened tubercles in *A. cookii* and spinulose tubercles or tuberculate spines in *A. cristatus*. However, the most reliable characters for separating these two species are found in the armature of the ventral margins of the dactyls of the 2nd and 3rd pereopods. In *A. cristatus* the ventral margins of the dactyls of both 2nd and 3rd pereopods are armed with a row of 20–24 corneous spines. In contrast, the ventral margins of the dactyls have only 9–15 corneous spines in *A. cookii*.

Remarks. White (1847) compiled a list of specimens present in the collections of the British Museum. Included among the Paguridae was "*Pagurus cristatus* Edw.". In his catalogue of the stalk- and sessile-eyed New Zealand Crustacea, Miers (1876) presented a species description of *A. cristatus* translated from Milne Edwards' (1836) original description. However, in his remarks, Miers (1876: 62) indicated that he had never seen specimens fitting Milne Edwards' description. Instead, he suggested that *A. crista-*

tus might be identical with *Eupagurus Gayi* Nicolet (= *Pagurus comptus* White), as described by Nicolet (1849) and illustrated in Gay's (1854: pl. i fig. 6) Atlas of Chile, or with *Pagurus novizealandiae* (Dana). In reference to White's (1847) specimens, Miers (1876) stated that White's specimens agreed in all respects with "*Eu. novae-zealandiae*" and placed White's taxon in synonymy with Dana's (1853) species. Alcock (1905) similarly listed White's (1847) *Pagurus cristatus* as a synonym of *Eupagurus novizealandiae*; however, his action was based only on literature citations. Obviously both White (1847) and Miers (1876) incorrectly interpreted *A. cristatus*, as Milne Edwards' (1836) species is clearly distinct from either *Pagurus comptus* or *P. novizealandiae*.

Thompson (1930) provisionally assigned specimens to *A. cookii* that he thought fell into two distinct groups. One group he believed agreed with Thomson's (1898) description of *A. cookii*, whereas the second group corresponded to Filhol's (1885b) figure of this species. Thomson's (1898) description of the flattened tubercles on the chelae of *A. cookii* is accurate; Filhol's (1885b) figure is not. It is possible that Thompson's (1930) second group may have been *A. cristatus*, but we have not had the opportunity to verify this hypothesis.

As stated in the introduction, McLaughlin's (1981a) assignment of Milne Edwards' (1836) species to *Lophopagurus* was incorrect.

As previously noted, Batham (1969), Probert et al. (1979), Rainer (1981), Sehembri and McLay (1983), Probert and Wilson (1984), and Sehembri (1988) reported "*A. cookii*" (as *Pagurus*, *Pylopagurus* or *Australeremus*) from Stewart Island and the Otago region. The reference material of "*A. cookii*" deposited at the Portobello Marine Laboratory and referred to by Sehembri and McLay (1983) and Sehembri (1988) as "*A. cookii*" consists of both *A. cookii* and *A. kirkii* (personal examination). Four lots of specimens from the National Museum of New Zealand (Cr4910, 7403) identified as "*A. cookii*" have been found to actually represent *A. cristatus*. It is clear that considerable confusion has existed in the identification of these species which all apparently show the red spot of colour on the palms of the chelipeds described by Sehembri and McLay (1983) as characteristic of *A. cookii*.

Four male specimens of *A. cristatus* we examined from Kaikoura and east of Pompeys Pillar (NMNZ Cr3965, 4910) were found to have paired first pleopods modified as gonopods.

Only in one was parasitism by a rhizocephalan apparent. This individual also had one female gonopore. The remaining three males had well developed male gonopores and typical male pleopods 3-5. Although "intersex" individuals (e.g., male and female gonopores present in the same individual) have been reported for a few species of diogenids and pagurids (e.g., Wenner, 1972; McLaughlin, 1974) this is the first time that we have observed female gonopods developed in obviously non-parasitized males. However, as inferred by Hoggarth (1990), the absence of externa does not preclude infection by rhizocephalan parasites.

Australeremus kirkii (Filhol)

Figure 12

Eupagurus Kirkii Filhol. 1883: 66.

Eupagurus Kirkii. — Filhol. 1885b: 416. pl. 51, fig. 5.

Eupagurus kirkii. — Thomson. 1898: 175. pl. 20, figs 8-10. — Alcock. 1905: 176.

?*Eupagurus kirkii*. — Thompson. 1930: 269 (see remarks).

Eupagurus kirki. — Borradaile. 1916: 95.

Pagurus kirkii. — Gordan. 1956: 331.

Pylopagurus kirkii. — Forest and de Saint Laurent. 1967: 145.

Pylopagurus kirki. — McLaughlin. 1981a: 3.

?*Lophopagurus kirki*. — McLaughlin. 1981a: 3 (by implication).

Not *Eupagurus kirkii* Miers. 1884: 267, pl. 28, fig. C. (= *Eupagurus hedleyi* Grant and McCulloch, 1906).

Type material. Syntypes: New Zealand, Cook Strait, 1883, Muséum National d'Histoire Naturelle, Paris (male, 4.4 mm; female, 4.3 mm).

Other material. RV *Tangaroa* stn BS 916 (NZOI stn 0.662), off Spirits Bay (34°25.0'S, 172°46.6'E), 29 m, 3 Feb 1981. NMNZ Cr7581 (4 males, 2 females, 2.5-3.6 mm). RV *Tangaroa* stn BS 871 (NZOI stn 0.617), off Rangaunu Bay (34°49.6'S, 175°15.0'E), 23 m, 27 Jan 1981, NMNZ Cr7591 (2 males, 1 female, 2.4-3.1 mm). Bay of Islands, 13 m, 7 Dec 1973, NMNZ Cr7387 (1 male, 2.4 mm). N side of Shakespeare Bay, 10 m, 26 Jan 1978, NMNZ Cr4112 (1 male, 1.7 mm). East Bay, outer Queen Charlotte Sound, C. Duffy, 12 m, 23 Oct 1989 NZCD Cr17, (1 male, 1 female, 3.4, 3.9 mm). Off Papakura Point, East Bay, Queen Charlotte Sound, C. Duffy, 30 m, 15 Jun 1990, USNM 244235, NHRM 16677, RMNH D 40430 (5 males, 1 female, 1 ovigerous female, 2.3-5.7 mm). South Trio Island, Marlborough Sounds, S. Cook and P. Fullerton, 30 m, 5 Apr 1990, NZCD Cr63 (4 males, 2 females, 1 ovigerous female, 2.0-3.5 mm). Continental shelf off Otago Peninsula, P. Sehembri, PML (3 males, 3.9-5.2 mm).

Redescription. Shield longer than broad;

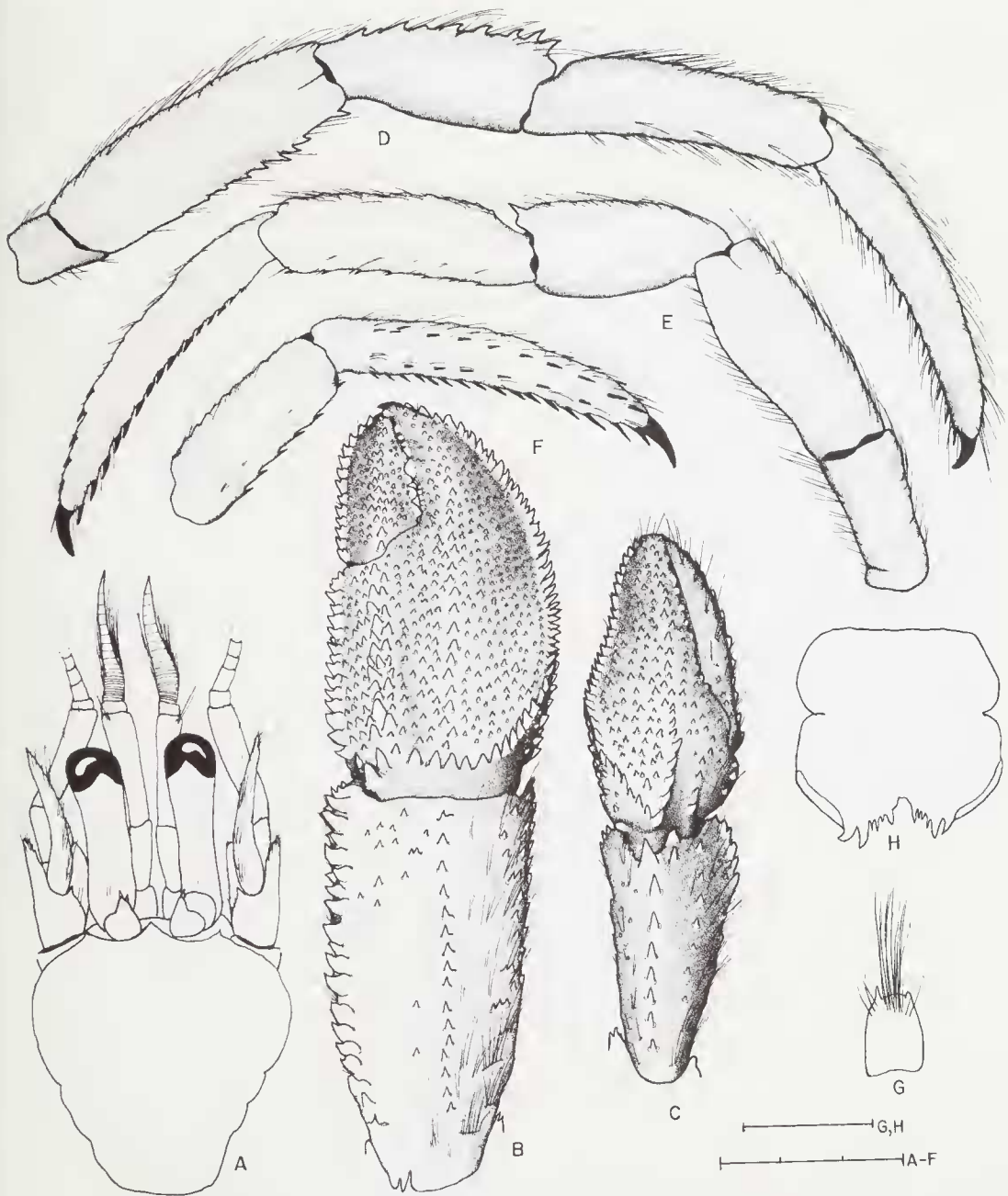


Figure 12. *Australeremus kirkii* (Filhol), male syntype, from Cook Strait, New Zealand, MNHN. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view), C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, left 3rd pereopod (lateral view); F, propodus and dactyl of left 3rd pereopod (mesial view); G, anterior lobe of sternite of 3rd pereopods; H, telson. Scales = 3 mm (A–F) and 1 mm (G, H).

anterior margin between rostrum and lateral projections concave; posterior margin truncate. Rostrum triangular, acute, terminating in small spine or spinule, occasionally with pair of

minute spinules. Lateral projections broadly triangular, with moderately well developed marginal or submarginal spine. Posterior carapace with tufts of setae adjacent to cervical groove.

Ocular peduncles $\frac{3}{4}$ – $\frac{4}{5}$ shield length, corneae slightly dilated. Ocular acicles acutely triangular, with strong submarginal terminal spine and occasionally accessory marginal spine; separated basally by slightly less than basal width of 1 acicle.

Antennular peduncles overreach ocular peduncles by $\frac{1}{2}$ – $\frac{2}{3}$ length of ultimate segment. Ultimate segment with 3 or 4 long setae at dorso-lateral distal angle.

Antennal peduncles overreach ocular peduncles by $\frac{1}{5}$ – $\frac{1}{2}$ length of ultimate segment. Fifth and fourth segments with scattered setae. Third segment with small spine at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in simple or bifid spine, 1–5 accessory spines on mesial margin, 1 or 2 on lateral margin; dorsomesial distal angle with acute spine. First segment with small spine at laterodistal margin. Antennal acicle sometimes overreaching cornea, terminating in small spine, mesial face with row of tufts of long setae. Antennal flagellum reaching nearly to tip of right cheliped; every second segment with 2 or 3 long (5–6 article length) setae and usually 1 or 2 short setae, at least in proximal $\frac{2}{3}$.

Right cheliped with dactyl slightly shorter to slightly longer than palm; terminating in corneous claw and slightly overlapped by fixed finger. Dorsomesial margin of dactyl with row of small spines, dorsal surface slightly elevated in midline and armed with row of small spines, surface mesially and laterally with numerous small spines or spinulose tubercles. Palm $\frac{2}{3}$ – $\frac{3}{4}$ length of carpus; dorsomesial margin depressed, armed with row of moderately small spines, 1 strong spine at proximal angle dorsolateral and dorso-proximal margins each with row of spines; dorsal surface with numerous spinules or spinulose tubercles on both palm and fixed finger, palm with surface slightly elevated in midline and near dorsomesial margin and armed with irregular single or double row of small spines; lateral face somewhat convex and with few scattered tubercles and tufts of short setae; mesial face and ventral surface similarly armed and ornamented. Carpus slightly longer than merus; dorsomesial margin with row of moderately strong spines and few supplemental spines distally, dorsal surface with row of widely-spaced spines mesial of midline and row of closely-spaced spines laterad of midline, additional transverse, sometimes spinulose ridges and tufts of setae laterally, dorsolateral margin delimited only faintly by transverse, occasionally spinulose ridges extending onto lateral face; ventrolateral

margin with row of small spines or spinulose tubercles, as least in distal half; mesial face somewhat concave, with spinulose tubercles dorsally, distal margin with spinulose tubercles decreasing in size ventrally. Merus with 1 or 2 strong spines at dorsodistal margin, dorsal surface with transverse ridges and tufts of long setae, extending onto lateral and mesial faces; ventromesial margin with row of small spines or spinulose tubercles, ventrolateral margin with row of somewhat stronger spines. Ischium with row of small spines or spinules on ventromesial margin.

Left cheliped with propodal-carpal angle of articulation 50° – 60° from horizontal plane. Dactyl 3 to 4 times longer than palm, somewhat triangular in cross-section; terminating in corneous claw; ventrally positioned dorsomesial margin with row of small spines, irregular single or double row of small protuberances or spinules on dorsal midline. Palm approximately $\frac{1}{3}$ length of carpus; dorsal surface convex but without median ridge or crest, dorsolateral margin with row of small spines, extending onto fixed finger, dorsal surface laterad of midline with scattered small spinules or spinulose tubercles, midline with small irregular row of spines extending onto fixed finger, dorsomesial surface with few small spines or spinulose tubercles, dorsomesial margin usually with 2 or 3 spinulose tubercles or spines. Carpus approximately equal to length of merus; dorsolateral margin with row of strong acute spines, dorsomesial margin sloping distally and with row of small spines or transverse ridges accompanied by tufts of long setae; mesial face with scattered low tubercles and often 2–4 small spines on distal margin dorsally, ventromesial margin with 1 or 2 rows of tubercles or tuberculate spines in distal half; lateral face with few spinulose tubercles and tufts of setae, laterodistal margin with few small spines in dorsal half; ventral surface often tuberculate and with transverse rows of tufts of setae. Merus with long setae on dorsal surface and dorsodistal margin; lateral and mesial faces each with few transverse rows of long setae, ventrolateral margin with row of small spines, usually strongest in distal half, ventromesial margin with few spines or spinulose tubercles. Ischium with row of small spinules on ventromesial margin.

Second and 3rd pereopods similar from left to right. Dactyls exceeding length of propodi by $\frac{1}{3}$ – $\frac{3}{4}$ own length; terminating in strong moderately elongate corneous claws; dorsal surfaces each with low protuberances, tufts of stiff setae and often few corneous spinules, lateral faces each

with faint longitudinal sulcus and scattered setae, mesial faces each with dorsal and ventral row of small corneous spinules, ventral margins each with row of 13–16 corneous spines. Propodi slightly longer than carpi; dorsal surfaces all with low protuberances and tufts of setae, ventral surfaces each with row of corneous spinules and tufts of setae. Carpi each with row of spines and tufts of setae on dorsal margin (2nd) or low protuberances, tufts of setae and single dorsodistal spine (3rd), rarely 3rd also with 1 or 2 additional small spines. Meri with tufts of stiff setae on dorsal margins, ventral margins each with tufts of setae and row of spines at least in distal half (2nd) or low protuberances and tufts of setae (3rd). Ischia with tufts of setae on ventral margins.

Sternite of third pereopods with anterior lobe subsemicircular to subsemiovalate, anterior margin sometimes with 1 or 2 calcareous spines and with long, stiff setae. Fourth pereopods with small preungual process at base of claw. Telson with terminal margins subcircular to oblique and armed with several calcareous spines, strongest toward outer angles; lateral plates usually with fused denticles.

Colour. In recently (6 weeks) preserved material: Shield mottled red-orange. Ocular peduncles white, acicles with faint red-orange hue. Antennular peduncles opaque with orange at distal margins of ultimate and penultimate segments. Antennal peduncles orange; flagella in proximal half red-orange dorsally and ventrally, white laterally and mesially, with every 4th or 5th article completely white; distal half uniformly red-orange interrupted by white every 4 to 6 articles. Chelae red-orange with tips of dactyls and fixed fingers white or light orange and with red patches on palms dorsally and ventrally at point of articulation with dactyls and ventrally at articulation with carpi, spines red. Carpi uniformly red-orange, darkest at proximal margins. Meri red-orange with band of white at distal margins. Ambulatory legs with uniformly orange dactyls; propodi and carpi light orange or white with longitudinal orange or red-orange stripes; meri orange, but with colour fading unevenly.

Distribution. New Zealand, North Island, Cook Strait, off Otago Peninsula; 12–30 m.

Affinities. Among the species of *Australeremus*, *A. kirkii* bears a superficial resemblance to *A. cookii* and has occasionally been mistakenly identified as that species (personal examin-

ation). The presence, in *A. kirkii* of spines or spinulose tubercles on the chelae, rather than the flattened tubercles characteristic of *A. cookii* immediately distinguishes this species. Two other species of *Australeremus*, *A. cristatus* and *A. eltaninae* sp. nov., also have chelae armed with spines or spinulose tubercles; however, in both these species the propodal-carpal articulation is greater (80°–85°) and the dorsal surface of the left palm is not convex.

Remarks. In the original description (Filhol, 1883) *kirkii* was misspelled as "*Krikii*". Filhol (1885b) subsequently corrected this spelling. Thompson's (1930) assignment of specimens to this species appears tentative, as he remarked "A few small specimens, perhaps referable to this species, are present in the collection".

As previously noted, McLaughlin's (1981a) assignment of Filhol's species to *Australeremus* was based only on Filhol's (1883, 1885b) descriptions and illustration and a photograph of one of the syntypes; therefore the assignment was considered questionable until actual specimens could be examined.

No data are available for the specimens of *A. kirkii* in the Portobello Marine Laboratory collection; however they apparently were collected from the continental shelf off the Otago Peninsula (P.K. Probert, pers. comm.).

Australeremus stewarti (Filhol)

Figures 8B, D, F; 13A–H

Eupagurus Stewarti Filhol, 1883: 67. — 1885b: 418, pl. 51 fig. 3.

Eupagurus stewarti. — Thomson, 1898: 180. — Alecock, 1905: 176. — Chilton, 1911: 298 (in part, see remarks). — Thompson, 1930: 269.

Pagurus stewarti. — Gordan, 1956: 335.

Pylopagurus stewarti. — Forest and de Saint Laurent, 1967: 145. — Probert et al., 1979: 381. — McLaughlin, 1981a: 3. — Schembri, 1982: 869. — 1988: 93. — Schembri and McLay, 1983: 30, figs 12a, b, 14. — Probert and Wilson, 1984: 389. — Taylor et al., 1989: 1062.

? Not "a hermit crab". — Morton and Miller, 1968, fig. 215 (2) by implication of Schembri and McLay (1983).

Type material. Holotype not seen.

Other material. New Zealand, Wanganella Bank, Norfolk Ridge, RV *Tangaroa* stn BS 886 (NZOI stn 0.632) (32°35.3'S, 167°41.8'E), 422–437 m, 29 Jan 1981, NMNZ Cr8144 (1 female, 2.0 mm). USNS *Eltanin* stn 23/1709 (43°31'S, 176°10'W), 143–183 m, 24 May 1966, USNM 244445 (4 males, 1 female, 1.5–3.3 mm). Chatham Island Expedition stn 34 (44°4'S,

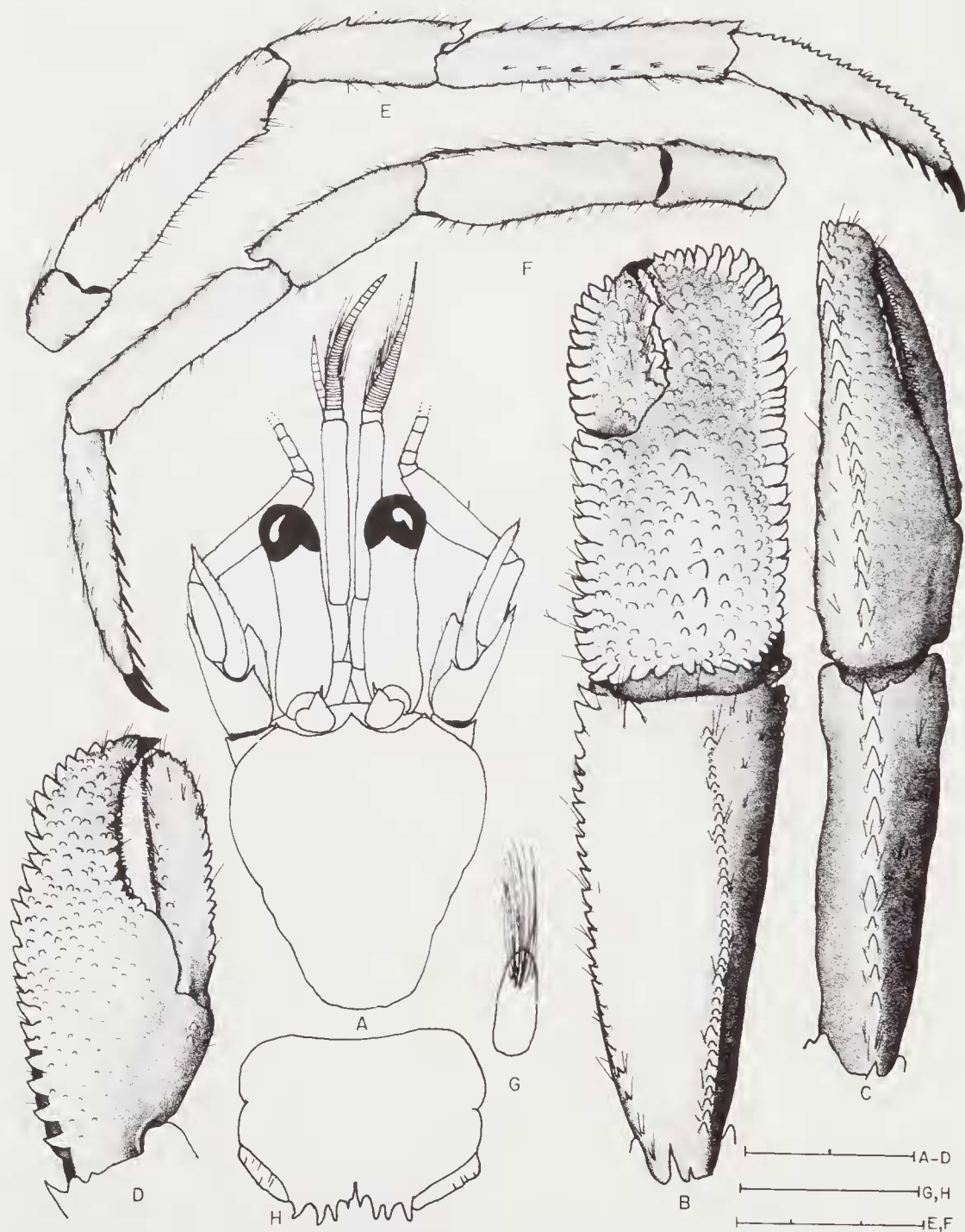


Figure 13. *Australeremus stewarti* (Filhol), male from *Eltanin* stn 23/1709, USNM 244445. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view), C, chela and carpus of left cheliped (dorsal view); D, chela of left cheliped (dorsomesial view); E, right 2nd pereopod (lateral view); F, left 3rd pereopod (lateral view); G, anterior lobe of sternite of 3rd pereopods; H, telson. Scales = 3 mm (E, F), 2 mm (A-D) and 1 mm (G, H).

175°25.5'E), 238 m, 1 Feb 1954, NMNZ Cr3900, 3901, 3902 (1 male, 2 females, 1.3–2.2 mm). NZOI stn B 196 (46°20.6'S, 170°27.6'E), 135 m, 18 Oct 1959, NMNZ Cr3905 (1 male, 3.2 mm). *James Cook* stn 100573, mid Foveaux Strait, 28 m, NMNZ Cr3903, 3904 (1 male, 1 female, 3.2, 3.4 mm). USNS *Eltanin* stn 16/1430 (49°19'S, 171°36'E) 165–192 m, 22 Feb 1965, USNM 244444, 244451 (3 males, 2 females, 1 juvenile, 0.4–2.8 mm). USNS *Eltanin* stn 51/590 (52°08.5'S, 169°43.7'E), 91–92 m, 20 Jan 1972, USNM 244453, NHRM 16676, RMNH D 40432 (27 males, 19 females, 4 ovigerous females, 1.0–2.7 mm).

Redescription. Shield is considerably longer than broad; anterior margin between rostrum and lateral projections concave. Rostrum acutely triangular, terminating in small spinule. Lateral projections obtusely triangular, with small submarginal spine.

Ocular peduncles $\frac{2}{3}$ – $\frac{3}{4}$ length of shield, moderately stout. Ocular acicles triangular, terminating rather bluntly but with strong submarginal spine; separated basally by $\frac{2}{3}$ –entire basal width of 1 acicle.

Antennular peduncles overreach ocular peduncles by $\frac{1}{2}$ – $\frac{2}{3}$ length of ultimate segment.

Antennal peduncles overreach ocular peduncles by $\frac{1}{2}$ – $\frac{2}{3}$ length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with ventrodistal margin unarmed. Second segment with dorsolateral distal angle produced, terminating in acute spine, mesial margin with 0–2 accessory spinules; dorsomesial distal angle with strong spine. First segment with dorsolateral distal angle sometimes with small spine. Antennal acicle not reaching tip of cornea, terminating in small spine and with tufts of setae on mesial face. Antennal flagellum not overreaching right cheliped, every article, at least proximally, with 2 or 3 long (3–5 article length) setae.

Right cheliped with subrectangular, often elongate carpus and chela. Dactyl $\frac{1}{3}$ – $\frac{2}{3}$ length of palm; cutting edge with 2 or 3 strong calcareous teeth in proximal $\frac{2}{3}$, short row of corneous teeth distally; terminating in corneous claw; dorsomesial margin with row of strong, somewhat blunted spines, dorsal surface with scattered weak to prominent tubercles. Palm $\frac{2}{3}$ –slightly less than half length of carpus; dorsomesial, dorsoproximal and dorsolateral margins all with row of strong, somewhat blunted spines entirely circumscribing palm and fixed finger, dorsal surface level or slightly convex and with numerous small to prominent, sometimes spinulose tubercles, occasionally becoming heavily calcified nodules, largest forming irregular row in

midline but frequently not extending onto fixed finger; cutting edge of fixed finger with large calcareous teeth proximally and smaller teeth distally; terminating in corneous claw, dorsal surface with numerous small to moderately large tubercles and few scattered setae. Carpus $\frac{1}{3}$ – $\frac{1}{2}$ longer than merus, dorsal width $\frac{1}{2}$ or appreciably less (large specimens) than length; dorsomesial margin with row of spines becoming stronger and more acute distally, 1 strong spine near dorsodistal margin, row of low sometimes spinulose tubercles on dorsolateral margin proximally curving mesially onto dorsal surface in distal half, but frequently also delimited distally by short row of tubercles, dorsal surface with few scattered tufts of setae; lateral and ventral surfaces with transverse rows of tubercles or protuberances and few setae. Merus acutely triangular in cross-section; dorsodistal margin with 1 strong acute spine and often second smaller spine; ventrolateral margin with row of spines in distal third, ventromesial margin with row of spines in proximal $\frac{2}{3}$. Ischium with row of blunt spines on ventromesial margin.

Left cheliped with propodal-carpal articulation 85°–90° from horizontal plane. Dactyl 2–3 times length of palm, dorsoventrally flattened; cutting edge with row of corneous teeth, terminating in small corneous claw; dorsal surface unarmed or with row of low tubercles near cutting edge, dorsomesial margin with row of low tubercles or spinules at least distally and few tufts of setae. Palm $\frac{1}{3}$ – $\frac{1}{6}$ length of carpus; dorsolateral margin of palm and fixed finger with row of strong spines, dorsal surface generally flattened, armed with numerous weak to prominent tubercles, stronger and more numerous on fixed finger, dorsomesial margin with few setae and occasionally 1 or 2 small tubercles. Carpus acutely triangular in cross-section; dorsal margin with row of sharp spines visually continuous with marginal spines of palm and fixed finger; distal margins laterally and mesially with 1–3 small spines, lateral and mesial faces with scattered setae. Merus as long or slightly longer than carpus; dorsal margin with low protuberances and tufts of setae, dorsodistal margin with strong spine; ventrolateral distal angle sometimes with 1 acute spine, ventromesial margin with row of spines. Ischium with row of spines on ventral margin.

Ambulatory legs dissimilar. Second pereopods with dactyls $\frac{2}{3}$ – $\frac{3}{5}$ length of propodi, somewhat laterally flattened, dorsal margins each usually with row of strong spines, occasionally only protuberances; ventral margins each with 8–10 corneous spines and scattered tufts

setae. Propodi exceed carpi by $\frac{1}{4}$ – $\frac{1}{3}$ own length; sometimes with spine at dorsodistal margin, dorsal surfaces usually with low protuberances or small spines and tufts of setae, ventrodorsal margins each with 1 corneous spinule. Carpi $\frac{2}{3}$ – $\frac{1}{2}$ length of meri; dorsal margins each with 1 spine at distal margin, usually 1 additional spine in proximal half and row of tufts of setae. Meri elongate; dorsal surfaces with low protuberances and tufts of setae, ventrolateral margins with or without 1 spine distally. Third pereopods differ in having narrower dactyls with unarmed dorsal margins; propodi lack spine at dorsodistal margin or on dorsal surfaces; carpi with only dorsodistal spine; meri lack spine at ventrolateral distal angles. Ischia of both 2nd and 3rd pereopods unarmed, but with tufts of setae.

Sternite of 3rd pereopods with narrowly triangular or rod-like anterior lobe terminating with tuft of setae. Fourth pereopods with short dactyl; small preungual process at base of claw. Fifth abdominal somite usually with numerous stiff setae dorsally. Uropods symmetrical. Telson with terminal margins of posterior lobes straight, slightly oblique, or slightly rounded, armed with 2 to 4 strong spines and occasionally 1 or 2 small spines, lateral plates often weakly calcified.

Colour. "Eystalks pale orange; antennules uniform pale yellow; antennae reddish with narrow white bands; chelipeds reddish-pink to orange with some darker markings and a purple band at the distal end of the inner surface of the pereopodites (this band varies in intensity from very distinct to faded); walking legs orange ground colour with white bands towards the tips." (Schembri and McLay, 1983).

Distribution. Wanganella Bank, North Island, Chatham Islands, southern New Zealand and Tasman Sea to 52°S latitude; 28–457 m.

Affinities. *Australeremus stewarti* appears most closely allied to *A. eltaninae* sp. nov. Both species have spatulate pereopodal dactyls, the second being dorsally armed with spines or spinulose protuberances. Similarly the chelae are armed with tear-drop shaped spines, although these are usually stronger in the latter species, and the pereopodal carpi have only a single spine at the dorsodistal margin and frequently 1 additional spine in the proximal half of the dorsal surface (2nd). In large specimens (SL >3.0 mm) the length-width ratio of the carpus of the right cheliped immediately distinguishes the two species. The carpus in *A. stewarti* is $2\frac{1}{2}$ –3

times longer than wide, whereas this segment is only $\frac{1}{3}$ – $\frac{1}{4}$ longer than wide in *A. eltaninae*. In smaller specimens of *A. stewarti* this ratio is not as pronounced; however, the carpal length is still at least twice the width. The mesial surface of this segment is rounded or relatively straight in *A. stewarti*; however, because of the flared dorsomesial margin in *A. eltaninae* the mesial face is noticeably concave. If both species are available for comparison, the subrectangular shape of the right chela of *A. stewarti* immediately sets this species apart from *A. eltaninae* with its subtriangular chela.

In general configuration of the chelipeds and frequently in armature of the dactyls of the 2nd pereopods, *A. stewarti* also bears a superficial resemblance to *A. cookii*. However, several characters provide easy separation of the two species. The dorsal surfaces of the chelae, particularly the right, are armed with flattened, closely-spaced tubercles in *A. cookii*; the carpi of the 2nd (at least right) and frequently also the 3rd pereopods are provided with a row of spines. In *A. stewarti* the armature of the dorsal surface of the chelae varies from small spinules to well developed, large tubercles, strongest in the midline on the right chela; the dorsal surfaces of the carpi of the 2nd pereopods are armed only with one spine at the dorsodistal margin and one additional spine in the proximal half. *Australeremus stewarti* is distinct from all other species currently assigned to the genus in having a covering of stiff setae on the dorsal surface of the fifth abdominal somite; however, as these setae may be broken off, it is not considered diagnostic.

Remarks. Filhol (1883) described, but did not illustrate *Eupagurus stewarti* from a single male specimen collected at Stewart Island off the southern coast of New Zealand. In a subsequent publication, Filhol (1885b) repeated his description, which was then accompanied by an illustration. This later publication was cited by both Thomson (1898) and Chilton (1911) as the date of original description. Filhol's figure (1885b, pl. 51 fig. 3) of *A. stewarti* is inaccurate in that the left chela is shown in a horizontally plane position in its relationship to the carpus; the abdomen is depicted with paired abdominal pleopods. Thomson's (1899) diagnosis of this species was simply a translation of Filhol's (1883; 1885b) description. Thomson apparently had not seen the species.

The specimens referred to *A. stewarti* by Thomson (1930) included those reported on earlier by Chilton (1911). Thomson found both

A. stewarti and *A. cookii* represented, but could not determine the range of *A. stewarti* since specimens from the *Nora Niven* stns had been combined. Schembri and McLay (1983) and Schembri (1988) reported *A. stewarti* off the Otago Peninsula, and our present material extends the eastern range of this species to off Chatham Island. However, the specimen from *Nora Niven* stn 79 (Porangahau Bay) (cf. Chilton, 1911) south of Cape Kidnappers, North Island is probably correctly referred to *A. cookii*.

Schembri and McLay (1983) referred to Morton and Miller (1968) in citing the habitat of *A. stewarti* as "bryozoan tubes", thus implying that the authors' caption "a hermit crab, with a polyzoan-formed extension to its gastropod shell" for figure 215 (2) referred to *A. stewarti*. Given the broadly rounded dorsolateral margin of the right chela depicted by Morton and Miller, it is more probable that the species illustrated was *A. cookii*, which is also known to inhabit bryozoan tubes.

Australeremus triserratus (Ortmann)

Figure 14, plate 1

Eupagurus triserratus Ortmann, 1892: 308, pl. 12 fig. 15. — Alcock, 1905: 177 (list). — Balss, 1913: 52 (key). — Terao, 1913: 373.

?*Eupagurus tricarinatus*. — Balss, 1913: 58 (? not *Eupagurus tricarinatus* Stimpson, 1858) (see remarks).

?*Eupagurus triserratus*. — Yokoya, 1933: 84. — Kamita, 1958: 67 (see remarks).

Eupagurus triserratus(?). — Shiino, 1936: 184 (see remarks).

Eupagurus (Eupagurus) triserratus. — Melin, 1939: 29, figs 9, 10.

?*Pagurus tricarinatus*. — Gordan, 1956: 336 (in part) (see remarks). — Miyake, 1982: 197 (list) (see remarks).

?*Pagurus triserratus*. — Gordan, 1956: 336. — Miyake, 1978: 101, fig. 39. — Morgan, 1990: 26 (see remarks).

Pagurus triserratus. — Kim, 1964: 5, pl. 1 fig. 6. — 1970: 8. — 1973: 225, 599, fig. 50, pl. 65 fig. 30.

Pylopagurus serpulophilus Miyake, 1978: 120, pl. 4 fig. 4. — 1982: 120, pl. 40 fig. 5. — McLaughlin, 1981a: 3.

Type material. Lectotype (herein designated): type locality, Sagami Bay (Japan), 100 m, 1881, MZUS (male, 3.6 mm).

Paralectotype: MZUS (male, 3.3 mm).

Other material. Dr S. Bock's Japan Expedition: "Sagami Misaki Okinose", 150–300 m, 1914, NHRM 11537, 11290, USNM 244450 (4 males, 7 females, 4 ovigerous females, 1.1–2.7 mm). "Nordostlich von

Otojojima", 105 m, 31 Jul 1914, ZMUU (3 males, 1.4–1.6 mm). "Ostlich von Chichijima", 100 m, 1 Aug 1914, NHRM 14899 (3 males, 1 female, 1.1–2.3 mm). "Ostlich von Chichijima", 105 m, 7 Aug 1914, ZMUU (2 males, 0.8, 1.1 mm). "2 Meilen ostlich von Higashijima", 135 m, 7 Aug 1914, ZMUU (3 males, 3 females, 1 ovigerous, 1.2–1.6 mm) [Melin (1939) reported 2 males, 4 females]. "Ost fr channel", 120 m, 1 Aug 1914, ZMUU (1 female, 2.0 mm). SW of Kao-Hsiuhg, Taiwan, South China Sea, 72–91 m, 13 Oct 1972, F.B. Steiner, CAS 046659 (1 female, 1.7 mm).

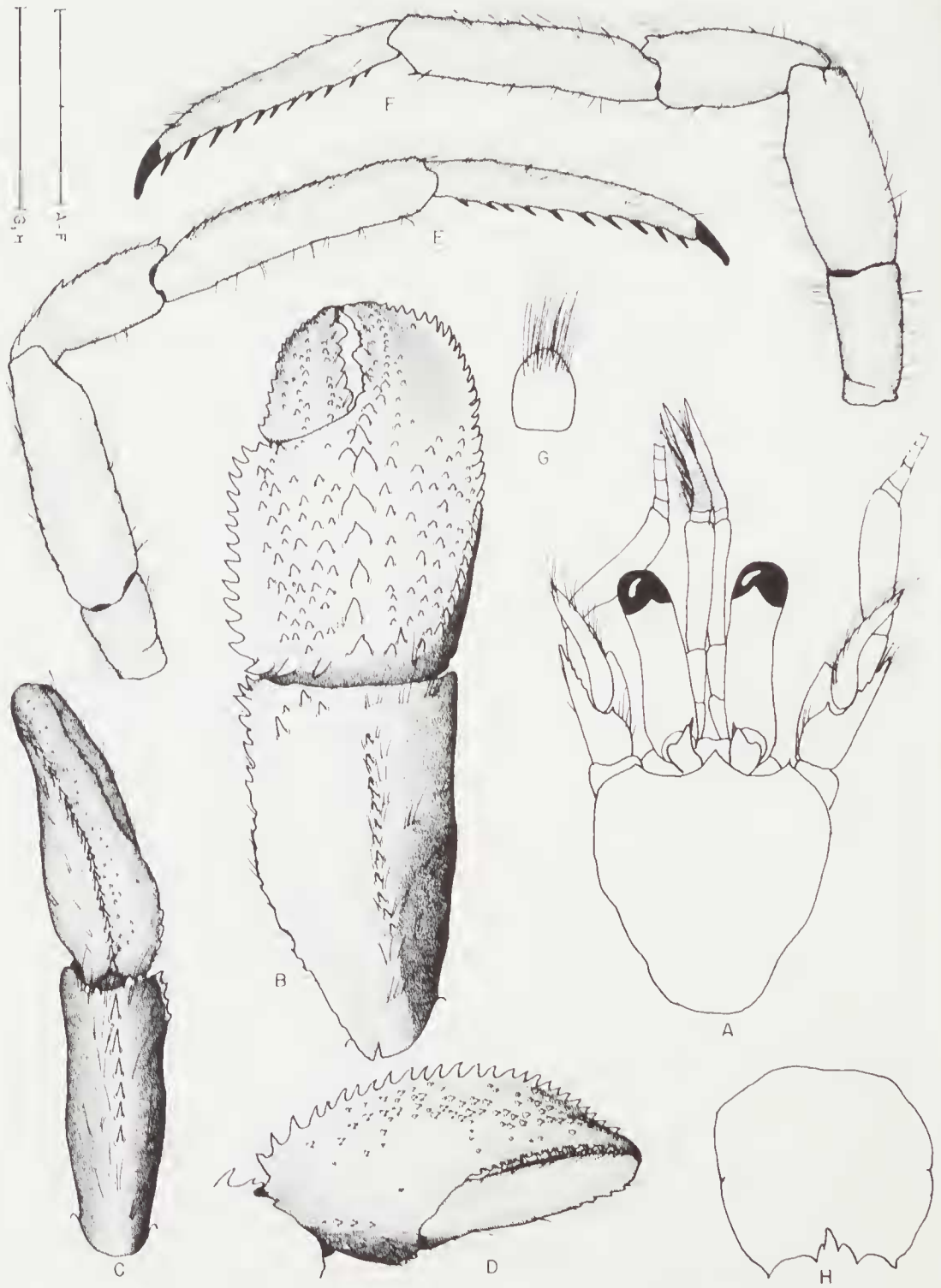
Redescription. Shield slightly to considerably longer than broad; anterior margin between rostrum and lateral projections concave. Rostrum acutely triangular, terminating in small spinule. Lateral projections broadly rounded, with marginal or submarginal spine. Posterior carapace usually with tufts of long setae mesially, adjacent to cervical groove.

Ocular peduncles $\frac{2}{3}$ – $\frac{4}{5}$ length of shield, moderately slender. Ocular acicles acutely triangular, terminating subacutely and with strong submarginal spine; separated basally by $\frac{3}{4}$ –entire basal width of 1 acicle. Interocular lobes weakly to moderately well developed.

Antennular peduncles overreach ocular peduncles by $\frac{1}{4}$ – $\frac{1}{2}$ length of ultimate segment.

Antennal peduncles overreach ocular peduncles by $\frac{1}{3}$ – $\frac{1}{2}$ length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with ventrodorsal margin unarmed. Second segment with dorsolateral distal angle produced, terminating in acute spine, mesial margin with 0 to several accessory spinules; dorsomesial distal angle with strong spine. First segment with acute spine at dorsolateral distal angle or unarmed. Antennal acicle not reaching distal margin of cornea, terminating in small spine and with tufts of setae on mesial face. Antennal flagellum not overreaching right cheliped; every article proximally with 2 or 3 long (4–6 article length) and 1 or 2 short setae, long setae every second article distally.

Right cheliped with dactyl $\frac{2}{3}$ –approximately equaling length of palm; cutting edge with 3 or 4 strong calcareous teeth in proximal five-sixths, short row of corneous teeth distally; terminating in corneous claw; dorsomesial margin with row of spines, dorsal surface with scattered low or sometimes spinulose tubercles. Palm $\frac{2}{3}$ – $\frac{4}{5}$ length of carpus; dorsomesial, dorsoproximal and dorsolateral margins all with row of acute spines entirely circumscribing palm and fixed finger, dorsal surface slightly convex and with numerous weak to prominent and occasionally spinulose tubercles, midline with single or



occasionally double row of spines decreasing in size on fixed finger and becoming obsolete near tip; cutting edge of fixed finger with large calcareous teeth proximally and smaller teeth distally; terminating in corneous claw, dorsal surface with few spinules or low tubercles and few scattered setae. Carpus $\frac{1}{4}$ – $\frac{1}{3}$ longer than merus, with mesial face appreciably concave in large specimens (SL > 2.0 mm); dorsomesial margin with row of spines becoming stronger and more acute distally. 1–3 spines at or near dorsodistal margin, row of small spines on dorsomesial margin proximally curving mesially onto dorsal surface in distal half, all surfaces with scattered tufts of setae. Merus triangular in cross-section; dorsodistal margin with 1 strong acute spine; ventrolateral margin with row of spines in distal third, ventromesial margin with 3 or 4 blunt to acute spines proximally. Ischium with row of blunt spines on ventromesial margin.

Left cheliped with propodal-carpal articulation 75° – 80° from horizontal plane. Dactyl $1\frac{1}{2}$ –2 times length of palm, dorsoventrally flattened; cutting edge with row of corneous teeth; terminating in small corneous claw; dorsal surface usually with few minute spinules near cutting edge, dorsomesial margin often with row of low tubercles or spinules and few tufts of setae. Palm half length of carpus; dorsolateral margin of palm and fixed finger with row of strong spines, dorsal surfaces generally flattened, armed with 2 irregular rows of tubercles or spinules, dorsomesial margin with few setae and occasionally 1 or 2 small tubercles. Carpus acutely triangular in cross-section; dorsal margin with row of acute spines, distal margin mesially with 1–3 small spines; frequently 1 or 2 blunt spines on ventromesial margin distally, lateral and mesial faces with scattered setae. Merus as long or slightly longer than carpus; dorsal margin with low protuberances and tufts of setae; ventromesial margin with row of small spines or spinules, ventrolateral margin usually unarmed in small specimens (< 2.5 mm), with row of well developed spines in larger specimens. Ischium with few spinules or tubercles on ventral margin.

Ambulatory legs generally similar (2nd right missing in lectotype). Dactyls as long or longer

than propodi; dorsal margins each with row of tufts of setae and 3 or 4 corneous spinules in distal half, ventral margins each with 7–11 corneous spines and scattered tufts of setae. Propodi $1\frac{1}{2}$ –2 times length of carpi; dorsal and ventral surfaces with low protuberances and tufts of setae, ventrodistal margins unarmed (2nd) or with 1 corneous spinule (3rd). Carpi $\frac{2}{3}$ – $\frac{3}{5}$ length of meri; dorsal margins each with 1 spine at distal angle, 2nd often also with 1 additional spine in proximal half. Dorsal and ventral surfaces of meri with low protuberances and tufts of setae. Ischia unarmed, but with tufts of setae.

Sternite of 3rd pereopods with semisubovate anterior lobe terminating with tuft of setae. Fourth pereopods with moderately short dactyls; small preungual process at base of claw. Dorsal surface of 6th abdominal somite frequently with few long setae; uropods symmetrical. Telson with terminal margins of posterior lobes straight or slightly oblique, armed with 2–4 strong spines and occasionally 1 or 2 small spines, lateral plates reduced.

Colour. "(in formalin). Ground colour of body and legs light red-brown. Carapace with one paired dark red-brown spots before and after cervical groove. Antennal flagellum with light and dark red-brown segments alternatively. Chela and wrist dark red-brown; merus light red-brown with three dark coloured cross-bands. Walking legs light red-brown; merus and dactylus each with two dark coloured cross-bands; carpus and propodus each with two dark coloured cross-bands." (Miyake, 1978).

Distribution. Sagami Bay, Sea of Sagami, Tanabe Bay, Amakusa, East China Sea (Miyake); Bonin Islands, South China Sea; 60–400 m.

Affinities. The armature of the chelipeds and pereopodal carpi suggest relationships among *A. triserratus*, *A. stewarti* and *A. eltaninae*; however, the armature of the dactyls of the 2nd pereopods immediately separates the latter two taxa from *A. triserratus*.

Remarks. Two apparently similar Japanese species have been reported and in some

Figure 14. *Australeremus triserratus* (Ortmann), ovigerous female from "Sagami Misaki Okinose", NHRM 11637. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view); C, chela and carpus of left cheliped (dorsal view); D, chela of left cheliped (dorsomesial view); E, right 2nd pereopod (lateral view); F, left 3rd pereopod (lateral view); G, anterior lobe of sternite of 3rd pereopods; H, telson. Scales = 2 mm (A–F) and 1 mm (G, H).

instances probably confounded, i.e., *Pagurus tricarinatus* (Stimpson, 1858) [not *P. tricarinatus* of Norman, 1869 = *P. alatus* Fabricius (Ingle, 1985)] and *Australeremus triserratus* (Ortmann, 1892). Stimpson's (1858) brief description of *P. tricarinatus* (repeated in 1907) seemingly was based on a single specimen, sex not indicated; the species has never been illustrated. Most of Stimpson's materials were lost in the Chicago fire of 1871 (cf. Rathbun, 1883); however, his description is sufficiently diagnostic in certain respects that it is probable that if found again this taxon could be recognized such as his "*Eupagurus acantholepis*" recently was (cf. Gunn and McLaughlin, 1989). It does not appear that *P. tricarinatus* is conspecific with *A. triserratus*.

Ortmann's (1892) description of *Eupagurus triserratus*, based on two males and one additional damaged lot, was brief and was accompanied by a single, rather uninformative illustration. He compared this species only to *E. tricarinatus* and separated the taxa primarily by the absence of a rostrum in the latter. We have now had the opportunity to examine the two male specimens described by Ortmann that remain in the collections of the Musée Zoologique, Strasbourg. Both differ from Stimpson's description of *P. tricarinatus* in several significant characters. *P. tricarinatus* is characterized by the absence of a rostrum, the presence of well developed interocular lobes, subequal chelipeds with the right palm bearing marginal and median denticulate keels or crests and ambulatory dactyls that are much longer than the propodi. Ortmann's syntypes both have a well developed rostrum, no appreciable development of interocular lobes, unequal chelipeds, and pereopodal dactyls that are approximately equal in length to their respective propodi. We select as the lectotype of *Eupagurus triserratus* the larger of the two specimens (SL = 3.6 mm).

Presumably because of its description from Japanese waters, Balss (1913) included *Eupagurus triserratus* in his species key, although it was not among the species he discussed in his report. He did make note of a single male specimen collected from Sagami Bay that he identified as *E. tricarinatus*, remarking that this taxon was only a variety of the European *E. excavatus* Herbst. The key character by which Balss distinguished *E. tricarinatus* from *E. triserratus* and other species was the absence of a rostrum in the former species. However, he remarked that his specimen differed from Stimpson's (1858) description by the presence of a distinct rostral

spine. We suspect that Balss actually had a specimen of *A. triserratus* rather than *P. tricarinatus*.

Terao (1913) listed both Stimpson's (1858) and Ortmann's (1892) species in his catalogue of Japanese hermit crabs, but remarked that he had not examined any material of either taxon.

Yokoya (1933) listed *Eupagurus triserratus* from several Japanese localities. For two of these he reported having female specimens; however, as he gave no diagnostic information it is uncertain as to whether he simply failed to notice paired gonopods in these females or in fact misidentified his taxon. He made no mention of *P. tricarinatus*.

The bopyrid isopod *Pseudione intermedia* Nierstrasz and Brender à Brandis was originally described from an unspecified locality in Japan with no host mentioned (Nierstrasz and Brender à Brandis, 1932). Subsequently Shiino (1936) redescribed it on the basis of material from Yahagi, Masaki, Japan as a parasite of "*Eupagurus triserratus*(?)". One specimen of *A. triserratus* from NHRM 11290 was found infected by a parasite of this species (Dr J.C. Markham, personal communication), thus lending support to Shiino's identification of the host hermit crab.

Two lots of "*Eupagurus (Eupagurus) triserratus*" from Dr Sixten Bock's Japan Expedition identified by G. Melin are present in the collections of the Naturhistoriska Riksmuseet, Stockholm and four in the collections of the Zoologiska Museet, Uppsala Universitet. Of these, four from the Bonin Islands (NHRM 14899, ZMUU) are cited by Melin (1939) in his redescription of Ortmann's (1892) species. Of the other two, one is also from one of Melin's Bonin Islands localities, the other from Sagami Bay (vicinity of 34°57'N 139°35'E). Although Melin's (1939) redescription is quite detailed, he failed to notice paired first pleopods in his female specimens and consequently retained the species in the nominal subgenus *Eupagurus*. Both of Ortmann's (1892) syntypes are larger than any of Melin's (1939) specimens and demonstrate some variations not seen in the smaller specimens. For example, the merus of the left cheliped is armed on both ventral margins in Ortmann's material, the dorsal surface of the right chela of the larger specimen has an almost double row of strong spines. In contrast, only the ventromesial margin of the merus of the left cheliped carries a row of spines in all of Melin's specimens and the dorsal surface of the right chela has a single median row of large spines. Nonetheless, it is clear that Melin's interpret-

ation of Ortmann's species was correct. The presence of females with paired first pleopods in the Bock Expedition material validates the assignment of this taxon to *Australeremus*.

Kamita (1958) cited *E. triserratus* in his discussion of geographical distributions of pagurids in Korea, but gave no information to indicate that he had actually examined this species, *P. tricarinatus* was not reported.

Gordan (1956) listed several citations under *P. tricarinatus*, only three of which appear to actually refer to Stimpson's (1858) taxon (i.e., Alcock, 1905; Balss, 1913, and Terao, 1913). As previously indicated, we suspect that Balss' (1913) report may actually refer to *A. triserratus*. Gordan's (1956) citations of *A. triserratus*, like those of Alcock (1905) were from literature surveys.

Kim (1964) reported *Pagurus triserratus* from Sogwipo, Cheju Do, Korea, based on two male specimens he had collected the previous year. Although he did not describe his material, his figure (pl. 1 fig. 6) strongly suggests that he did in fact have Ortmann's (1892) species. His subsequent reports (Kim, 1970, 1973) were based on these same two specimens.

In his report on the anomuran fauna of Sagami Bay, Miyake (1978: 101, fig. 39) figured and briefly described *Pagurus triserratus*. No mention is made by Miyake of torsion of the left chela and none is apparent in his illustration. Miyake's material included two males and one female from Japanese waters and one male from the East China Sea; however, gonopods in the female were not denoted. These two characters, if accurately reported would distinguish this taxon from *A. triserratus*. The Kyushu University crustacean collections were recently moved to Kitakyushu Museum of Natural History and have not yet been cataloged (Dr K. Baba, Dr K. Ueda, pers. comms), therefore we were unsuccessful in our attempt to examine the lot containing both male and female specimens (ZIKU 5604) to verify Miyake's description. In his index of species, Miyake (1978: 184) questionably equated *P. triserratus* to *P. tricarinatus*. Subsequently, he (Miyake, 1982) cited the taxon as *P. tricarinatus* (? = *P. triserratus*). However, his (Miyake, 1978) description of *P. triserratus* differs in several significant respects from Stimpson's (1858) description of *P. tricarinatus*. Miyake described his specimens as having a distinct rostrum; no mention is made of well developed inter-ocular lobes, nor are any illustrated. The chelipeds are unequal; the right palm reportedly is provided with dorsomesial and

dorsolateral marginal teeth and a median longitudinal row of tubercular teeth. The dactyls of the ambulatory legs are as long as the propodi. In all of these characters, Miyake's taxon agrees with Ortmann's species. Until the absence of female gonopods and the lack torsion of the left chela can be confirmed, we questionably assign Miyake's taxon to *A. triserratus*.

In his 1978 publication, Miyake also described *Pylopagurus serpulophilus* as a new species from Sagami Bay. The major difference between *P. serpulophilus* and *A. triserratus* would appear to be in the armature of the right cheliped. In his description of the right chela, Miyake made no mention of spines on the dorso-proximal margin, nor are any spines apparent in his illustration. However the photograph of *P. serpulophilus* in his subsequent report (Miyake, 1982, pl. 40 fig. 5) does show a row of dorso-proximal spines. We have found only two additional, and minor, differences between our specimens of *A. triserratus* and Miyake's (1978) description and illustration of *P. serpulophilus*. Miyake described the ocular peduncles of his species as short, however, his illustration (pl. 4 fig. 4) shows moderately long ocular peduncles. The smallest of our specimens do have relatively short ocular peduncles, but with increased specimen size, the ocular peduncles of *A. triserratus* are moderately long and slender. Similarly Miyake described the carpi of the pereopods as having only a single spine at the dorsodistal margin. Our one East China Sea specimen and most specimens of *A. triserratus* from Sagami Bay and the Bonin Islands have a second spine or spinule on the dorsal margin of the carpus of each 2nd pereopod; however, this spine is frequently very small and could easily be overlooked. On the basis of present evidence, we believe that *Pylopagurus serpulophilus* is conspecific with *A. triserratus*; the latter name has priority.

In his comparison of *Pagurus triserratus* with his new species *P. boriaustraliensis*, Morgan (1990) stated that the dactyls of the ambulatory legs of the former species were as long or longer than the propodi; the antennal flagella were extremely short. The pereopodal dactyls are approximately equal to the propodi in length in all specimens of *A. triserratus* that we have examined; however the antennal flagella, while not overreaching the right cheliped, cannot be considered extremely short. Since *A. triserratus* has not been reported from north-western Australia, we assume that Morgan's comparison was based only on Ortmann's (1892) description and figure.

Australeremus eltaninae sp. nov.

Figure 15

Type material. Holotype: New Zealand, USNS *Eltanin* stn 231/1716 (39°35'S, 178°46'E), 128–146 m, 28 May 1966, USNM 244463 (male (3.6 mm)).

Paratypes. RV *Tangaroa* stn BS 840 (NZOI stn O. 581), Ranfurley Bank (37°34.6'S 178°52.8'E), 35–39 m, 22 Jan 1981, NMNZ Cr8132 (1 male, 3.2 mm). RV *Tangaroa* stn BS 837 (NZOI stn O. 582), Ranfurley Bank (37°35.0'S 178°52.8'E), 31–47 m, 22 Jan 1981, NMNZ Cr8131 (3 males, 1.8–3.4 mm). RV *Tangaroa* stn BS 838 (NZOI stn O. 583), Ranfurley Bank (37°35.4'S 178°52.9'E), 34–54 m, 22 Jan 1981, NMNZ Cr8130 (2 females, 1.9, 2.0 mm). RV *Tangaroa* stns BS 834, 838 (NZOI stn O. 579), Ranfurley Bank (37°36.7'S 178°51.6'E), 56–63 m, 22 Jan 1981, NMNZ Cr8060, 8133 (1 male, 1 female, 1.8, 2.8 mm). RV *Tangaroa* stn BS 840 (NZOI stn O. 585), Ranfurley Bank (37°38.4'S 178°51.7'E), 79–83 m, 22 Jan 1981, NMNZ Cr8148, 8150 (3 males, 1 female, 1.9–2.5 mm).

Description. Shield as long or longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin truncate; dorsal surface with few scattered setae. Rostrum triangular, with small terminal spinule. Lateral projections broadly rounded, with small submarginal spine.

Ocular peduncles $\frac{3}{4}$ – $\frac{1}{2}$ shield length, corneae slightly dilated; dorsomesial surface with row of short setae. Ocular acicles acutely triangular, with strong submarginal spine; separated basally by slightly less to slightly more than basal width of 1 acicle.

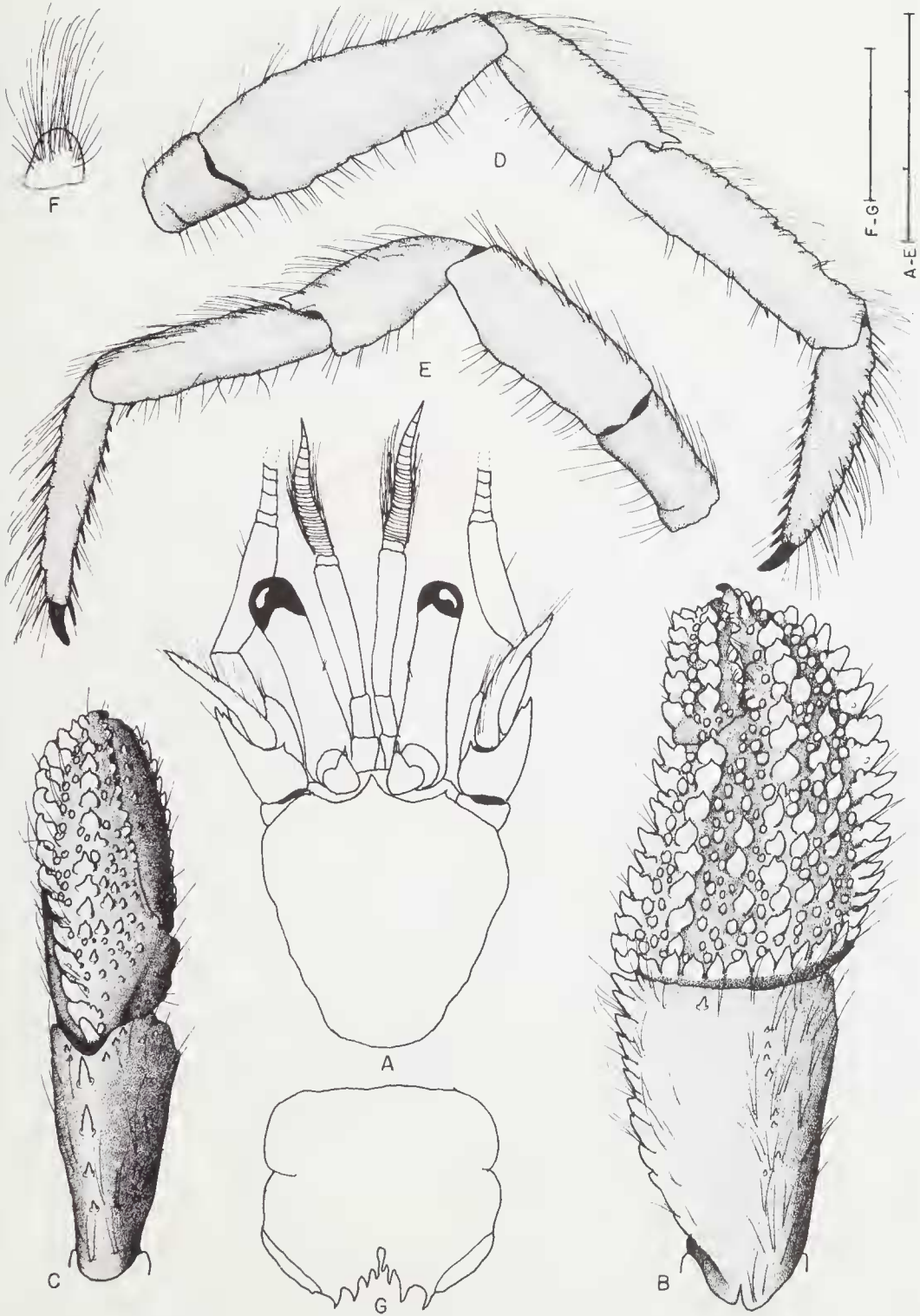
Antennular peduncles exceeding ocular peduncles by $\frac{1}{4}$ – $\frac{1}{2}$ length of ultimate segment. Ultimate segment with several setae at dorsolateral distal angle. Penultimate segment with few scattered setae. Basal segment with small spine on lateral face dorsally.

Antennal peduncles overreach ocular peduncles by $\frac{1}{4}$ – $\frac{1}{3}$ length of ultimate segment. Fifth and fourth segments with scattered setae. Third segment with small spinule at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in acute spine, mesial and lateral margins usually with 1–4 accessory spinules, and tufts of setae; dorsome-

sial distal angle with acute spine. First segment with small spine at laterodistal margin; ventral margin produced and with 1 small spine laterally. Antennal acicle reaching beyond base of cornea, strongly arcuate, terminating in strong spine; mesial face with row of tufts of short to moderately long setae. Antennal flagellum with 2–4 long and 1 or 2 short setae every article proximally and every second to fourth article distally.

Right cheliped (missing in holotype) with subtriangular chela (dorsal view); dactyl shorter than palm; slightly overlapped by fixed finger, terminating in small corneous claw; cutting edge with row of large calcareous teeth; cutting edge of fixed finger also with row of calcareous teeth. Dorsomesial margin of dactyl with row of strong spines, dorsal surface with 2 rows of prominent, blunt tubercles, mesial and ventral surfaces with scattered setae. Palm $\frac{1}{2}$ – $\frac{2}{3}$ length of carpus; dorsomesial, dorsoproximal and dorsolateral margins with strong acute spines circumscribing palm and extending complete length of fixed finger as broad, blunt spines, dorsal surface with row of strong, tear-drop shaped spines adjacent to dorsomesial margin, separated from similar, but stronger median row by slight longitudinal depression, remaining surface of palm and fixed finger with tear-drop shaped, acute or blunt tuberculate spines, frequently interspersed with mushroom-shaped tubercles; mesial, ventral and lateral surfaces unarmed but with scattered setae. Carpus equaling or slightly exceeding length of merus, dorsoventrally considerably deeper than palm; dorsal width $< \frac{3}{4}$ length; dorsomesial margin flared and armed with row of strong acute spines, dorsal surface with only longitudinal row of small spines or spinulose tubercles laterad of midline and rarely 1 small spine at dorsodistal margin; lateral face with row of transverse ridges and tufts of setae dorsally, ventrolateral margin occasionally crenulate; mesial face noticeably concave, unarmed; ventral surface with scattered setae. Merus triangular, dorsal margin with few tufts of setae and strong spine at distal margin; ventromesial margin with 4 or 5 acute or blunt spines, ventrolateral margin with short row of acute spines in distal half; ven-

Figure 15. *Australeremus eltaninae* sp. nov. A, C, E–G holotype, from *Eltanin* stn 231/1716, USNM 244463; B, D, male paratype, from Ranfurley Bank, New Zealand, NMNZ 8132. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view); C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, left 3rd pereopod (lateral view); F, anterior lobe of sternite of 3rd pereopods; G, telson. Scales = 3 mm (A–E) and 1 mm (F, G).



tral surface occasionally with 1 or 2 spines distally and with scattered tufts of setae. Ischium with row of small spines on ventromesial margin.

Left cheliped with propodal-carpal articulation 60° – 80° from horizontal plane. Dactyl $2\frac{1}{2}$ – $3\frac{1}{2}$ times longer than palm, somewhat flattened; terminating in strong corneous claw and slightly overlapped by fixed finger; cutting edge with row of corneous teeth; dorsomesial margin with protuberances or small blunt spines, spinules or tubercles proximally, becoming spine-like distally, dorsal surface with few protuberances and short setae. Palm $\frac{1}{5}$ – $\frac{1}{4}$ length of carpus; dorsolateral margin with row of strong spines, dorsal surface covered with moderate to strong, often tear-drop-shaped spines, sometimes interspersed with mushroom-shaped tubercles, spines smallest and more tuberculate in mesial half, dorsomesial margin with 2 low protuberances and few tufts of setae; lateral and ventral surfaces with low protuberances and scattered tufts of setae. Carpus approximately equaling merus in length; strongly triangular in cross-section; dorsal surface with row of strong acute spines; mesial face with few transverse ridges and tufts of setae, mesiodistal margin with 3 small spines in distal half, ventromesial margin with low protuberances and few long setae; lateral face often with scattered spinules or protuberances and tufts of setae, distal margin with few spinules in dorsal half. Merus with few long setae on dorsal surface; ventral surface appreciably deeper in proximal half, ventrolateral margin with row of acute spines in distal third, ventromesial margin with row of spines, sometimes only in proximal half. Ischium with row of small spines on ventromesial margin.

Ambulatory legs generally similar (2nd right missing in holotype). Dactyls slightly shorter or approximately as long as propodi; somewhat blade-shaped, terminating in strong corneous claws; dorsal margins with low protuberances occasionally developed into spinose processes, row of long corneous spines and tufts of long, stiff setae; lateral and mesial faces with tufts of setae, ventral margins each with row of 7–11 corneous spines. Propodi $\frac{1}{4}$ – $\frac{1}{2}$ longer than carpi; with low protuberances and tufts of long setae on dorsal surfaces, ventral surfaces each with tufts of long setae and 2–4 corneous spines in distal half. Carpi of 2nd pereopods with low protuberances and tufts of setae on dorsal surface, frequently also 1 spine or spiniform process in proximal half and 1 or 2 spines at distal margin; dorsal surface of carpi of 3rd occasionally also

with spine in proximal half but only single spine at dorsodistal margin. Meri with tufts of setae on dorsal and ventral surfaces. Ischia with tufts of setae dorsally and ventrally.

Sternite of 3rd pereopods with anterior lobe small, semioval to subsemicircular, and with very long setae on anterior margin. Fourth pereopod with small preungual process at base of claw. Uropods generally symmetrical. Telson with terminal margins rounded, few spines medianly, plate-like laterally and extending onto lateral margins.

Colour. Unknown.

Distribution. New Zealand, known only from the type locality and the Ranfurly Bank; 31–146 m.

Etymology. This species is named for the research vessel USNS *Eltanin*.

Affinities. *Australeremus eltaninae* is most closely related to *A. stewarti* and *A. triserratus*. The stronger and more prominent spines of the chelae and the blade-shaped pereopodal dactyls immediately distinguish *A. eltaninae* from *A. triserratus*. As previously discussed, *A. eltaninae* is best distinguished from *A. stewarti* by the shape of the chela of the right cheliped and length/width ratio of the carpus of this appendage. However, the row of spines on the ventrolateral margin of the merus of the left cheliped also quickly distinguishes *A. eltaninae* from the latter species where only a single spine is occasionally present. The two species differ also in the configuration of the ventral surfaces of the carpus and merus. The entire carpus and the proximal portion of the merus of the right cheliped are appreciably deeper in *A. eltaninae*.

Remarks. Despite the absence of the right cheliped and second right pereopod, the distinctness of this species was recognized when the parasitized male holotype was initially observed. Subsequently we were able to examine a series of specimens, including females, collected from Ranfurly Bank which enabled us to confirm the placement of this species in *Australeremus* and present a complete description.

Acknowledgements

The authors wish particularly to acknowledge the prior work on New Zealand hermit crabs by Jacques Forest and Michèle de Saint Laurent, and the information and comparative materials

they graciously provided for this study. We are indebted to Drs Gordon Hendler, Jon Norenburg and Rafael Lemaitre, former or present benthic supervisors at the Smithsonian Oceanographic Sorting Center, for making the US Antarctic collections available. We also acknowledge with thanks the assistance provided by J. Haig, Allan Hancock Foundation, University of Southern California; P.B. Berents, Australian Museum; R. Ingle and P. Clarke, The Natural History Museum; R. Van Syoc, California Academy of Sciences; I. Mannering, Canterbury Museum; K. Ueda, Kitakyushu Museum of Natural History; K. Baba, Kumamoto University; E. Lang, Musée Zoologique, Strasbourg; J. Forest, Muséum National d'Histoire Naturelle, Paris; L.B. Holthuis and C.H. Fransen, Nationaal Natuurhistorisch Museum, Leiden; R.B. Manning, National Museum of Natural History, Smithsonian Institution; W.R. Webber, J.C. Yaldwyn and G.R.F. Hicks, National Museum of New Zealand; G.C.B. Poore, Museum of Victoria; L. Sandberg, Naturhistoriska Rijsmuseet, Stockholm; C. Duffy, New Zealand Department of Conservation; P.K. Probert, Portobello Marine Laboratory; R.L.C. Pilgrim and C. McLay, University of Canterbury; and L. Wallin, Zoologiske Museet, Uppsala Universitet for providing information and/or in making material available for our examination. Information on and the identification of the bopyrid isopod was provided by J.C. Markham. The photographs of *A. triserratus* are the work of E.J. McGeorge. The overall quality of the manuscript has been improved by the careful editing of R. Lemaitre, W.R. Webber and an anonymous reviewer. The initial phase of this study was supported by National Science Foundation grant DEB 76-02552; its completion has been made possible by a Cooperative Systematics Research Program Grant from the Smithsonian Institution and Division of Polar Programs, National Science Foundation. This is a scientific contribution from the Shannon Point Marine Center, Western Washington University.

References

- Alcock, A., 1905. *Catalogue of the Indian decapod Crustacea in the collections of the Indian Museum. Part 2. Anomura. Fasc. I. Pagurides.* pp. 197. Indian Museum: Calcutta.
- Anonymous, 1985. *International code of zoological nomenclature adopted by the XX General Assembly of the International Union of Biological Sciences:* 1-338. International Trust for Zoological Nomenclature: London.
- Balss, H., 1913. Ostasiatische Decapoden I. Die Galatheiden und Paguriden. In: *Beiträge zur Naturgeschichte Ostasiens. Abhandlungen der mathematisch-Physikalischen Klasse der Königlich Bayerischen Akademie der Wissenschaftern, II. Supplement* 9: 1-85.
- Batham, E.J., 1969. Benthic ecology of Glory Cove, Stewart Island. *Transactions of the Royal Society of New Zealand. Biological Sciences* 11 (5): 73-81.
- Bell, T., 1844-1853. *A history of the British stalk-eyed Crustacea.* John van Voorst: London. 386 pp. (Issued in parts: pp. 1-48, 1844; pp. 49-96, 1844; pp. 97-144, 1845; pp. 145-192, 1846; pp. 193-240, 1847; pp. 241-288, 1848; pp. 289-336, 1851; pp. 337-386, 1852; pp. ix-lxii, lxii-lxv, 1853.)
- Borradaile, L.A., 1916. Crustacea. Part I. Decapoda. *British Antarctic ("Terra Nova") Expedition, 1910. Natural History Report. Zoology* 3 (2): 75-110.
- Chilton, C., 1911. Scientific results of the New Zealand Government trawling expedition, 1907. Crustacea. *Records of the Canterbury Museum* 1: 285-312.
- Dakin, W.J., Bennett, I. and Pope, E., 1948. A study of certain aspects of the ecology of the intertidal zone of the New South Wales coast. *Australian Journal of Scientific Research* (B) 1: 176-230.
- Dakin, W.J., Bennett, I. and Pope, E., 1953. *Australian seashores. A guide for the beachlover, the naturalist, the shore fisherman, and the student.* pp. 372. Angus and Robertson: Sydney.
- Dakin, W.J., Bennett, I. and Pope, E., 1960. *Australian seashores. A guide for the beachlover, the naturalist, the shore fisherman, and the student.* (Revised edition) pp. 372. Angus and Robertson: Sydney.
- Dana, J.D., 1853. Crustacea. *United States Exploring Expedition during the Years 1838, 1839, 1840, 1841, 1842. Under the command of Charles Wilkes, U.S.N.* 13 (1): vii + 685 pp. C. Sherman: Philadelphia. [Reprinted 1972 Antiquariaat Junk: Lochem].
- Filhol, H., 1883. Note sur quelques espèces nouvelles d'*Eupagurus* recueillis en Nouvelle-Zélande. *Bulletin de la Société Philomatique de Paris* (7) 8 (2): 66-68.
- Filhol, H., 1885a. Considerations relatives à la faune des crustacés de la Nouvelle-Zélande. *Bibliothèque de l'École des Hautes Études, Section des Sciences Naturelles* 30 (2): 1-60.
- Filhol, H., 1885b. *Recueil de Mémoires, Rapports et Documents relatifs à l'Observation du Passage de Vénus sur le Soleil du 9 Décembre 1874. Mission de l'Île Campbell.* *Zoologie*, 3 (2) 1: 349-510. Institut de France, Académie des Sciences: Paris.
- Forest, J., 1961. Note sur *Pagurus thompsoni* (Filhol) = *P. lacertus* Henderson). In: R.B. Pike, A new bopyrid parasite collected by the Chatham Islands 1954 Expedition. *New Zealand Department of*

- Scientific and Industrial Research, Bulletin* 139 (Biological results of the Chatham Islands 1954 Expedition, part 5): 223.
- Forest, J. and Saint Laurent, M. de, 1968. Campagne de la "Calypso" au large des côtes Atlantiques de l'Amérique du Sud (1961-1962). 6. Crustacés Décapodes: Pagurides. *Annales de l'Institut Océanographique de Monaco* n. s. 45 (2): 47-172.
- Gordan, J., 1956. A bibliography of pagurid crabs, exclusive of Alcock, 1905. *Bulletin of the American Museum of Natural History* 108: 253-352.
- Grant, F., 1902. In: O.A. Sayce, 1902. Dredging on Port Phillip. *The Victorian Naturalist* 18: 154-155.
- Grant, F.E. and McCulloch, A.R., 1906. On a collection of Crustacea from the Port Curtis District, Queensland. *Proceedings of the Linnean Society of New South Wales* 1906: 1-53.
- Griffin, D.J.G., 1967. Hermit crabs. *Australian Natural History* 15 (10): 305-309.
- Gunn, S.W. and McLaughlin, P.A., 1989. The rediscovery of *Pagurus acantholepis* (Stimpson) (Decapoda: Anomura: Paguridae). *Memoirs of the Museum of Victoria* 49 (1): 67-71.
- Hale, H.M., 1927. *The Crustaceans of South Australia*. Part I. pp. 210. Government Printer: Adelaide.
- Hale, H.M., 1941. Decapod Crustacea. *Reports of the British, Australian and New Zealand Research Expedition 1929-1931 Series B (Zoology and Botany)* 4 (9): 257-286.
- Healy, A. and Yaldwyn, J., 1970. *Australian Crustaceans in Colour*. pp. 112. Reed: Sydney.
- Hemming, F. (Ed.), 1957. Opinion 472. Addition to the official list of generic names in zoology of the generic name *Pagurus* Fabricius, 1775, with *Cancer bernhardus* Linnaeus, 1758, as type species (Class Crustacea, Order Decapoda). *Opinions and Declarations of the International Commission for Zoological Nomenclature* 16: 213-276.
- Hemming, F., 1958. *Official index of rejected and invalid generic names in zoology* I. pp. xii, 132. International Trust for Zoological Nomenclature: London.
- Henderson, J.R. 1888. The voyage of H.M.S. Challenger. Report on the Anomura collected by H.M.S. Challenger during the years 1873-76. *Reports on the Scientific results of the Voyage of H.M.S. Challenger during the years 1873-76. Zoology* 27: 1-221.
- Hoggarth, D.D., 1990. The effects of parasitism by the rhizocephalan, *Briarosaccus callosus* Boschma on the lithodid crab, *Paralomis granulosa* (Jacquinot) in the Falkland Islands. *Crustaceana* 59: 156-170.
- Hutton, F.W., 1882. The stalk-eyed Crustacea of New Zealand. *New Zealand Journal of Science* 1: 263-264.
- Ingle, R., 1985. Northeastern Atlantic and Mediterranean hermit crabs (Crustacea: Anomura: Paguroidea: Paguridae). I. The genus *Pagurus* Fabricius, 1775. *Journal of Natural History*, 19: 745-769.
- Kamita, T., 1958. Studies on the decapod crustaceans of Corea, Part II. Hermit-crabs (5). *Scientific Reports (Natural Science) of the Shimane University* 8: 59-75. (In Japanese).
- Kim, H.S., 1964. A study on the geographical distribution of anomuran decapods of Korea with considerations of the oceanographic conditions. *Sung Kyun Kwan University Journal* 8 (Supplement): 1-15. (In Korean).
- Kim, H.S., 1970. A checklist of the Anomura and Brachyura (Crustacea, Decapoda) of Korea. *Seoul National University Journal Biology and Agriculture Series (B)* 21: 1-34.
- Kim, H.S., 1973. *Illustrated Encyclopedia of Fauna and Flora of Korea*, 14. *Anomura-Brachyura*. pp. 694. Samhwa Publishing Co.: Seoul. (In Korean).
- Leviton, A.E., Gibbs, R.H. Jr., Heal E., and Dawson, C.E., 1985. Standards in herpetology and Ichthyology: Part I. Standard symbolic codes for Institutional Resource collections in herpetology and ichthyology. *Copeia* 1985: 802-832.
- Liszka, D. and Underwood, A.J., 1990. An experimental design to determine preferences for gastropod shells by a hermit-crab. *Journal of Experimental Marine Biology and Ecology* 137: 47-62.
- Manning, R.B. and Holthuis, L.B., 1981. West African brachyuran crabs (Crustacea: Decapoda). *Smithsonian Contributions to Zoology* 306: 1-379.
- McCulloch, A.R., 1913. Studies in Australian Crustacea. No. 3. *Records of the Australian Museum* 9: 321-353.
- McLaughlin, P.A., 1974. The hermit crabs (Crustacea Decapoda, Paguridea) of northwestern North America. *Zoologische Verhandlungen* 130: 1-396.
- McLaughlin, P.A., 1981a. Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with the descriptions of new genera and species: Part I. Ten new genera of the Paguridae and a redescription of *Tomopagurus* A. Milne Edwards and Bouvier. *Bulletin of Marine Science* 31: 1-30.
- McLaughlin, P.A., 1981b. Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with the descriptions of new genera and species: Part II. *Rhodochirus* McLaughlin and *Phimochirus* McLaughlin. *Bulletin of Marine Science* 31: 329-365.
- McLaughlin, P.A., 1982. Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with the descriptions of new genera and species: Part III. *Agaricochirus* McLaughlin, *Enallopagurus* McLaughlin, and *Enallopaguroopsis* McLaughlin. *Bulletin of Marine Science* 32: 823-855.
- McLaughlin, P.A. and Haig, J., 1984. A review of *Pagurixus* (Decapoda, Anomura, Paguridae) and descriptions of new species. *Crustaceana* 47 (2): 121-148.
- McLaughlin, P.A. and Haig, J., 1989. On the status of *Pylopaguroopsis zebra* (Henderson), *P. magnimanus* (Henderson), and *Galapagurus teevanus* Boone, with descriptions of seven new species of

- Pylopaguropsis* (Crustacea: Anomura: Paguridae). *Micronesica* 22 (2): 123-171.
- Melin, G., 1939. Paguriden und Galatheiden von Prof. Dr. Sixten Bocks Expedition nach den Bonin-Inseln. 1914. *Kongliga Svenska Vetenskapsakademiens Handlingar* (3) 18 (2): 1-119.
- Miers, E.J., 1876. *Catalogue of the stalk- and sessile-eyed Crustacea of New Zealand*. pp. 136. Colonial Museum and Geological Survey Department: London.
- Miers, E.J., 1884. Crustacea. *Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881-2*: 178-322, 513-575.
- Milne Edwards, A., 1880. Reports on the results of dredging under the supervision of Alexander Agassiz in the Gulf of Mexico, and in the Caribbean Sea. 1877, '78, '79 by the U.S. Coast Survey Steamer "Blake", Lieut.-Commander C.D. Sigsbee, U.S.N., and Commander J.R. Bartlett, U.S.N. commanding. VIII. Études préliminaires sur les Crustacés. *Bulletin of the Museum of Comparative Zoology* 8: 1-68.
- Milne Edwards, A. and Bouvier, E.L., 1891. Observations générales sur les paguriens recueillis dans la mer des Antilles et le Golfe du Mexique, par le *Blake* et le *Hassler*, sous la direction de M. Alexandre Agassiz. *Bulletin de la Société Philomatique de Paris* (8) 3: 102-110.
- Milne Edwards, A. and Bouvier, E.L., 1893. Reports on the results of dredging, under the supervision of Alexander Agassiz, in the Gulf of Mexico (1877-78), in the Caribbean Sea (1878-79), and along the Atlantic coast of the United States (188), by the U.S. Coast Survey steamer "Blake", Lieut.-Commander S.D. Sigsbee, U.S.N., and Commander J.R. Bartlett, U.S.N. commanding. XXXIII. Description des Crustacés de la famille des paguriens recueillis pendant l'expédition. *Memoirs of the Museum of Comparative Zoology* 14: 1-172.
- Milne Edwards, H., 1836. Observations zoologiques sur les Pagures et description d'un nouveau genre de la tribu des Paguriens. *Annales des Sciences Naturelles, Zoologie* (2) 6: 257-288.
- Milne Edwards, H., 1837. *Histoire naturelle des Crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux*. 2: 1-532; atlas, pp. 1-32, pls. 1-42. Paris.
- Milne Edwards, H., 1848. Note sur quelques nouvelles espèces du genre Pagure. *Annales des Sciences Naturelles, Zoologie* (3) 10: 59-64.
- Miyake, S., 1978. *The Crustacean Anomura of Sagami Bay*. pp. 200 (English), pp. 161 (Japanese). Hoikusha Publishing Co.: Tokyo.
- Miyake, S., 1982. *Japanese Crustacean Decapods and Stomatopods in Color*. I. Macrura, Anomura and Stomatopoda. pp. 261. Hoikusha Publishing Co.: Osaka.
- Morgan, G.J., 1990. A collection of Thalassinidea, Anomura and Brachyura (Crustacea: Decapoda) from the Kimberley region of northwestern Australia. *Zoologische Verhandlungen* 265: 1-90.
- Morton, J. and Miller, M., 1968. *The New Zealand Sea Shore*. pp. 638. Collins: London and Auckland.
- Nicolet, H. 1849. Crustaceos. In: C. Gay, *Historia fisica y politica de Chile* vol. 3 (Zoologia): pp. 1-547. Paris.
- Nicolet, H. 1854. Crustaceos. In: G. Gay, *Historia fisica y politica de Chile* Atlas vol. 2: 134 pls. Paris and Santiago.
- Nierstrasz, H.F. and Brender à Brandis, G.A., 1932. Alte und neue Epicaridea. *Zoologischer Anzeiger* 101: 90-100.
- Ortmann, A., 1892. Die Decapoden-Krebse des Strassburger Museum. IV. Die Abtheilungen Galathei-dea und Paguridea. *Zoologischer Jahrbucher Systematik* 6: 241-326.
- Pike, R.B., 1961. A new bopyrid parasite collected by the Chatham Islands 1954 expedition. In: *New Zealand Department of Scientific and Industrial Research, Bulletin* 139 (Biological results of the Chatham Islands 1954 Expedition, part 5): 221-223.
- Pope, E.C., 1947. The endless house-hunt. *Australian Museum Magazine* 9 (4): 129-132.
- Probert, P.K., Batham E.J. and Wilson, J.B., 1979. Epibenthic macrofauna off southeastern New Zealand and midshelf bryozoan dominance. *New Zealand Journal of Marine and Freshwater Research* 13 (3): 379-392.
- Probert, P.K. and Wilson, J.B., 1984. Continental shelf benthos of Otago Peninsula, New Zealand. *Estuarine, Coastal and Shelf Science* 19: 373-391.
- Rainer, S.F., 1981. Soft-bottom benthic communities in Otago Harbour and Blueskin Bay, New Zealand. *New Zealand Oceanographic Institute Memoir* 80: 1-28.
- Rathbun, R., 1883. Descriptive catalogue of the collection illustrating the scientific investigations of the sea and fresh waters. Great International Fisheries Exhibition, London, 1883. *Bulletin of the United States National Museum* 27: 513-621.
- Sayce, D.A., 1902. Dredging on Port Phillip. *Victorian Naturalist* 18: 149-155.
- Schembri, P.J., 1982. Feeding behaviour of fifteen species of hermit crabs (Crustacea: Decapoda: Anomura) from the Otago region, southeastern New Zealand. *Journal of Natural History*, 16: 859-878.
- Schembri, P.K., 1988. Bathymetric distribution of hermit crabs (Crustacea: Decapoda: Anomura) from the Otago region, southeastern New Zealand. *Journal of the Royal Society of New Zealand* 18 (1): 91-102.
- Schembri, P.J. and McLay, C.L., 1983. An annotated key to the hermit crabs (Crustacea: Decapoda: Anomura) of the Otago region (southeastern New Zealand). *New Zealand Journal of Marine and Freshwater Research* 17: 27-35.
- Shiino, S.M., 1936. Bopyrids from Misaki. *Records of Oceanographic Works in Japan* 8: 177-190.
- Stimpson, W., 1858. Crustacea. Prodromus descriptionis animalium vertebratorum, quae in expe-

- ditione ad oceanum Pacificum septentrionalem, a Republica Rederata missa, Cadwaldaro Ringgold et Johanne Rodgers ducibus, observavit et descripsit. VII. – [Preprint (December 1858) from] *Proceedings of the Academy of Natural Sciences of Philadelphia* 1858: 225–252.
- Stimpson, W., 1907. Report on the Crustacea (Brachyura and Anomura) collected by the Pacific Exploring Expedition, 1853–1856. *Smithsonian Miscellaneous Collections* 49 (1717): 1–240.
- Taylor, P.D., Schembri P.J., and Cook, P.L., 1989. Symbiotic associations between hermit crabs and bryozoans from the Otago region, southeastern New Zealand. *Journal of Natural History*, 23: 1059–1085.
- Terao, A., 1913. A catalogue of hermit-crabs found in Japan (Paguridae excluding Lithodidae), with descriptions of four new species. *Annotationes Zoologicae Japonenses* 8 (2): 355–391.
- Thomson, G.M., 1898. A revision of the Crustacea Anomura of New Zealand. *Transactions and Proceedings of the New Zealand Institute* 31: 167–197.
- Thompson, E.F., 1930. Contributions for a revision of the New Zealand Crustacea of the family Paguridae. *Records of the Canterbury Museum* 3 (4): 263–273.
- Wenner, A.M., 1972. Sex ratio as a function of size in marine Crustacea. *The American Naturalist* 106: 321–350.
- White, A., 1847. *List of the Specimens of Crustacea in the Collection of the British Museum*. pp. vii + 143. British Museum: London.
- Whitelegge, T., 1889. List of the marine and fresh-water invertebrate fauna of Port Jackson and the neighbourhood. *Journal and Proceedings of the Royal Society of New South Wales* 23 (2): 163–323.
- Whitelegge, T., 1900. Scientific results of the trawling expedition of HMCS “Thetis” off the coast of New South Wales, in February and March, 1898. *Memoirs of the Australian Museum* 4: 135–199.
- Yaldwyn, J.C., 1975. Checklist of decapod and stomatopod Crustacea from Auckland and Campbell Islands, New Zealand Subantarctic. In: Yaldwyn, J.C. (Ed.) Preliminary Results of the Auckland Islands Expedition 1972–1973. *Department of Lands and Survey, Wellington (Reserve Series)* 1975/3 (10.8): 360–363.
- Yokoya, Y., 1933. On the distribution of decapod Crustacea inhabiting the continental shelf around Japan, chiefly based upon the materials collected by S.S. “Soyo Maru” during the years 1923–1930. *Journal of the College of Agriculture, Tokyo Imperial University* 12 (1): 1–236.
- Zarenkov, N.A., 1967. Crustacean Decapoda collected by the Soviet Antarctic Expeditions in the Antarctic and Antiboreal regions. *Biological Reports of the Soviet Antarctic Expedition (1955–1958)* 4: 153–201. [Translation by Israel Program for Scientific Translations, 1968].

Plate 1

Australeremus triserratus (Ortmann), lectotype, MZUS. Upper left. Whole specimen, dorsal view, 5.4 times. Lower left. Original label accompanying type lot, original size. Upper right. Enlarged dorsal view of right chela, 6.1 times. Lower right. Enlarged dorsomesial view of left chela, 7.2 times.



MUSÉE ZOOLOGIQUE
de
L'UNIVERSITÉ
et de la
VILLE
STRASBOURG

Type.
Eupagurus
triseriatus
Ostmann
Sagamihara
(Japan)
Journ. 1881.
Döderlein